THE WATERWHEEL
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WASTED WATER:
The expensive price of poor plumbing

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wdsa conference 2008

UNIVERSITY OF JOHANNESBURG

WDSA2008

The 2008 WDSA Conference (WDSA2008) will be the 10th in the WDSA series and the first to be hosted outside of the USA. WDSA2008 will take place from 17 to 20 August 2008 in the Kruger National Park, South Africa, a world famed wildlife sanctuary and one of the world's greatest natural assets. WDSA2008 is hosted by the University of Johannesburg.

CONFERENCE TOPICS

Abstracts are solicited on virtually all topics of relevance to water distribution systems analysis. Applied, theoretical, and methodological studies are welcome. Topic categories include:

- System Operation and Control
- System Design
- Optimisation Algorithms for System Design
- Real-Time Forecasting, Operational Analysis, and Control Event Detection
- Decision Support for Sustainable Water Management
- Vulnerability/Consequence Assessment
- Security and Reliability of Water Systems
- Water Quality Sensing and Monitoring
- Case Studies and Field Applications
- Hydraulic Transient Analysis
- Leak Detection
- Infrastructure Asset Management
- Model Calibration Algorithms and Applications
- Network Demand Modeling
- Network Hydraulic Models and Algorithms
- Network Water Quality Models and Algorithms
- Stochastic Simulation and Analysis
- Systems Integration or Integration with GIS/SCADA/CIS
- Water Supply in Developing Countries
- History and Heritage of Water Supply

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IWA International Water Association

water & forestry
Department: Water Affairs and Forestry
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WISA Water Institute of SA

EWRI

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GIMS

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***Cover**: The indiscriminate use of non-compliant plumbing products is costing South Africa millions of Rands, and litres, in wasted water. (See page 16).*

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LETTERS TO THE EDITOR

Flush toilets not ideal for SA

I read with interest that the International Year of Sanitation and AMCOW both regard a flush toilet leading to a septic tank or disposal system as the standard. Why do we blindly accept the wet Europe idea of the water closet in a drought-ridden country?

Whatever happened to the idea of separating the poisonous mix of urine and faeces instead of diluting it? What happened to all the good ideas of the alternative and whole earth societies of the 1960s and 1970s; sawdust toilet buckets, untreated toilet paper etc?

If everyone has a flush toilet will there be enough water left to drink or wash your hands with? Or will we have to adopt the Bedouin custom of eating with your right hand and performing ablutions – using desert sand – with your left?

Ben Dekker, Port St Johns

Water figures incorrect

The article on water conservation (Water & Energy Join Hands to Avert Future Crisis) in the *Water Wheel* May/June 2008 refers. We would like to point out an error in the water figures quoted in the article. Wherever Mℓ/year is reflected this should read million cubic metres a year i.e. 325 Mℓ/year should read 325 million cubic metres per year, 50 Mℓ/year should read 50 cubic metres per year and 3 Mℓ/year should read 3 million cubic metres per year.

Nandha Govender, Water Procurement Manager, Eskom

VIPs – there is a way

The article on basic sanitation in the *Water Wheel* May/June 2008 ('On-site Sanitation Challenges Tackled through Research') refers. Since 1985, I have supplied and erected over 4 000 VIP toilets. Some of these have been used in high density informal settlements, such as Bloekombos and Somerset West in Cape Town. I have the following comments regarding the article:

Far too much emphasis is placed by municipalities and other organisations on the superstructure with the result that too much money is spent above ground, which translates to less toilets through budgetary constraints, which ultimately ends with too many people per toilet. The Cape Town Municipality at present has upwards 50 people per toilet! The function is to provide some form of privacy.

Look at the background of the photo on p34. Do you need an immovable, aesthetically beautiful toilet, which 50 people use, among the iron and plastic sacks? Ask any one of the end consumers whether they would prefer their own DIY toilet to sharing a concrete unit with 50 other people.

Sannitree's experience has proved that by far the most successful methodology of servicing a high density informal settlement is as follows: Each dweller receives two concrete steel-reinforced slabs which have a hole to receive a funnel-type seat and a 100 mm pipe; two pit liners either weld mesh wrapped in shade cloth or plastic; a plastic funnel-shaped seat that can be easily removed for cleaning; a 2,4 m black 110 mm conduit pipe and fly trap; a galvanised skeleton frame and door for the superstructure which he clads himself; and a 600 mm by 600 mm paving slab.

Every six months the dweller simply unbolts the four securing brackets and moves the toilet to the second pit, placing the slab over the first pit that receives the toilet seat. The whole kit should not cost more than R500 delivered on site. This means five units would be erected for the price of one concrete type and at a fraction of the time. The reasons for expensive and frequent pump-outs are as follows: a) budgetary constraints reduce the quantity of toilets resulting in overloading. Since the bacteria cannot keep pace with the volume of faeces, pump outs will be frequent. This will increase malodours and b) because pit toilets are a natural breeding ground for flies, people panic when they see white worm-like larvae (maggots) and they use anti-bacterial fluids, chlorine or sheep dip to eradicate the problem.

A new product has been developed by our parent company for use in pit toilets which offers the benefits of rapid decomposition and a reduction in fly population. Two pits, 1,6 m deep, with a diameter of 900 mm will last a family of eight at least ten years without costly pump-outs.

Mike Mayne, Sannitree, Muizenberg

(Letter has been edited – Ed.)

Dam feature more than just aesthetic add-on

I was interested to read the article you published in *the Water Wheel* in May/June 2008 on the Hartbeespoort Dam.

The late Doug Hooper and I were involved in the design of the raising of the Hartbeespoort Dam in the late 1960s/early 1970s.

It might interest your readers that the miniature 'Arc de Triomphe' on the western side of the dam wall has a structural function and it is not purely an aesthetic embellishment. The spillway trough of the side channel spillway is located on the left (western) bank and the arch ends at this point. Normally an arch dam has contact with both flanks of the valley to distribute the water and other loads.

The original designers overcame this problem of supporting the 'free standing' upper portion of the arch on the left flank by the construction of the Arc de Triomphe. This solid addition adds additional weight to the left flank, thus ensuring stability of the arched dam wall.

Paul Roberts, Pretoria

Letters must be addressed to The Editor and can be faxed to (012) 331-2565 or E-mailed to laniv@wrc.org.za. Letters are published at the editor's discretion, and may be edited for length. Letters are strictly the opinion of the author(s) only and do not necessarily reflect the considered opinions of the members of *the Water Wheel* or the WRC.

Editor's Note: Preserving our water heritage

Regular readers of *the Water Wheel* will notice that we have introduced a new regular feature to our magazine. The Water History section will explore the past, taking a peak into the development and construction of some of South Africa's most impressive bulk water infrastructure. Our first feature in the May/June 2008 issue on the history of the Hartbeespoort Dam – still a major tourist attraction (and these days property development hub) despite its history of environmental problems – drew extensive and overwhelmingly positive response.

Water enthusiasts will know what a rich history the South African water sector has. Our engineers have designed and constructed some of the most impressive water infrastructure in the world. The Department of Water Affairs & Forestry counts around 30 dams with a full supply capacity of more than 170 million m^3, among them well known names such as Gariep, Vanderkloof, Sterkfontein, Pongolapoort, Bloemhof, Midmar, and Loskop dams. Each of these dams has a story to tell. While these stories are not always positive, it is important that we preserve them so as to learn from the valuable lessons they have to share.

Unfortunately, among the sector's other challenges, this wonderful institutional memory is disappearing fast. How many young people will know that the Lesotho Highlands Water Project was the brain child of engineer Ninham Shand or that the Gariep Dam was once named Hendrik Verwoerd Dam, after the so-called 'father of apartheid'?

The Water Wheel would like to call on our readers, many who have been part of these infrastructure projects, to help us preserve our water past. Please share your stories and your photographs with us. No tale is too small or too insignificant to tell. Help us remember the great dam builders of our past and to build a strong foundation for the future of our water sector.

To contribute to our Water History feature, write to the Editor, Private Bag X03, Gezina, 0031, or E-mail: laniv@wrc.org.za or Fax: (012) 331-2565. *(All sources will be credited and hard copy photographic material will be returned.)*

DWAF

The Gariep Dam (formerly known as Hendrik Verwoerd Dam) during construction in the 1970s

Groundwater guidelines available online

The Department of Water Affairs & Forestry's (DWAF's) *Guideline for the Assessment, Planning and Management of Groundwater Resources* in South Africa is now available online.

Many communities in South Africa rely on groundwater aquifers as their main or only source of water. While groundwater resources are increasingly being assessed and developed standard procedures have been lacking.

This prompted DWAF to develop the guideline that can be followed and adhered to when undertaking assessment, planning and management of groundwater resources in the country. It is anticipated that the guideline will lead to the sustainable development, protection and management of South Africa's groundwater resources, and will assist in achieving the overall goal of integrated water resource management within the department.

The guideline is presented in three chapters. The first chapter provides a conceptual overview in terms of the purpose of the guideline, the location of groundwater resources, the regulatory framework, principles and approaches, as well as institutional arrangements.

Chapter two provides details of the process and related activities that should be followed during the assessment, planning and management functions. Lastly, chapter three provides detailed procedures, in the form of checklists with guiding notes, for carrying out the assessment, planning and management functions.

To access the document, go to http://www.dwaf.gov.za/Documents/Other/Water%20Resources/GroundwaterPlanGuide-Mar08.asp

Water sector has work to do

While the South African water sector is on the right track it still has much work to do to ensure access to safe water for all in light of deteriorating water resources.
This is according to newly-inaugurated President of the Water Institute of Southern Africa (WISA), Dr Heidi Snyman.

"The *2007 State of Environment* Report states that a significant proportion of our usable water resources have been degraded and that most of our exploitable water resources are being utilised at present. The restriction on the fitness-for-use imposed by the water quality standards of the different water management areas regarding domestic, irrigation, and recreation use are significant due to increased pressures.

"If we as a sector take the concept of Water for Growth and Development and Integrated Water Resource Management (IWRM) seriously, we need to remind ourselves from time to time what the consequences are when we fail to meet our objectives," noted Dr Snyman. These consequences include the outbreak of waterborne diseases which particularly affect the poor, increased salinity, eutrophication and suspended solids as well as increased levels of contaminants, acidification and the unacceptable impact of solid waste.

Dr Snyman said that water professionals, through WISA, could contribute much more to addressing the challenges faced by the South African water sector. "WISA should give more attention to cross-cutting issues, such as IWRM that extend over several sectors. We can increase involvement with the agricultural sector, for example."

Government wants more engineers

As part of government's Joint Initiative for Priority Skills Acquisition (JIPSA), a target of producing 2 500 engineers a year has been set to help the country deal with skills shortages.

"JIPSA has targeted a limited number of priority skills thought to be some of the key constraints to economic growth," noted chief economist within the Presidency, Alan Hirsch. "The key to growth is infrastructure – roads, electricity, water and housing – and for that we need engineers."

Government has committed R439-million for the period 2007 to 20009 to improve teaching and learning infrastructure in South Africa.

Public invited to be water heros

WWF South Africa has launched its new 'Be the Hero' campaign, which invites individual South Africans to make a real difference in the state of our environment.

"There is a sense among people that environmental degradation is completely out of their hands, but this is simply not true," reports WWF South Africa CEO Dr Morné du Plessis. "There are basic steps that South Africans can take that will not only reduce our ecological footprint as a nation, but also save us money." The campaign particularly targets the middle to higher income groups, which are responsible for most of the country's water and electricity use.

Dr Du Plessis emphasises that consumers today are spoilt for choice and no longer have to accept whatever product they can get without knowing the background. "Today consumers increasingly have access to information about their product choices, and it is therefore our responsibility as individuals to make use of these resources."

The campaign is centred around a website (www.wwf.org.za/hero) which features information on topics such as water, waste, energy and food. Other sections include advice on greening one's home as well as a downloadable pocket size shopping guide, a green products and services directory and a directory of recycling service providers.

The website also acts as a forum for information sharing, as a blog is created for everyone who signs up. "If people were aware of simple facts such as that leaving the tap running while brushing teeth wastes nine litres of water a minute they would think twice before doing so," maintains Dr Du Plessis. If enough South Africans make these changes, the nett effect will be significant. In the case of the brushing teeth example, a million people turning the tap off while they brushed their teeth twice a day would save 18 million litres of water daily.

New steering committee to drive wetland rescue

A steering committee has been formed to drive the restoration process of the Klip River wetland, south of Johannesburg.

The committee includes representatives of the Department of Water Affairs & Forestry, Gauteng Department of Agriculture, Conservation & Environment, City of Johannesburg, Rand Water and the South African National Biodiversity Institute.

The wetland plays an extremely valuable role as it treats the polluted waters arising from the western section of the Witwatersrand urban-industrial-mining complex. However, increased inflows of water, mainly treated effluent from surrounding wastewater treatment works are threatening the future of the wetland (for more information, see the article on p23 of *Water Wheel* March/April 2008).
Source: Working for Wetlands

WATER DIARY 1

SANITATION
SEPTEMBER 24-26
An international conference on sustainable sanitation will be held in Ouagadougou, Burkina Faso. Visit: www.netssaf.net/170.0.html

TRANSBOUNDARY WATER
OCTOBER 15-18
The 4th International Symposium on Transboundary Water Management will take place in Thessaloniki, Greece. Visit: www.inweb.gr/twm4

Water Minister puts her foot down

The Department of Water Affairs & Forestry (DWAF) is to take stronger action against municipalities who continue to put the health of their communities and the environment at risk through sub-standard water and wastewater treatment and supply.

This is according to Minister of Water Affairs & Forestry Lindiwe Hendricks. She was delivering her budget vote in Parliament in May.

In the past DWAF has been criticised for not taking more severe action against municipalities delivering sub-standard quality drinking water or whose non maintenance of wastewater treatment works has led to raw sewage leaking into the environment. Department officials had always cited government's policy of 'cooperative governance' as the reason for not taking these municipalities to court, even though it is authorised by law to do so. But, according to Hendricks the days of playing 'buddy-buddy' with non-compliant local authorities are over.

She noted that court action could be a lengthy process, leaving municipalities at risk. As a result, her department was looking at other means of remedying the situation. "Despite DWAF support it has become apparent that there are municipalities that clearly cannot perform their functions, and my department is working with the Department of Provincial and Local Government to re-examine the powers and functions allocated to such municipalities," announced Hendricks. She said that letters had already been sent to municipalities whose water quality did not meet national standards, giving them 30 days to come up with plan of action to address the situation.

"We are now looking at the legislative and regulatory framework to identify the means of taking over their water quality management function, and where water boards can be used to perform some of these functions in the event that municipalities are found wanting."

DWAF was also collaborating with the Department of Environmental Affairs & Tourism to strengthen its ability to fight environmental and water crimes. The minister said the Green Scorpions might be used in future to investigate alleged water crimes, including illegal water use and pollution.

"I will not tolerate any activities which may in any way compromise our water security in terms of both quality and quantity. DWAF is planning a zero tolerance campaign later this year."

Department to boost technological innovations

The Department of Sciency & Technology is to create a Technology Innovation Agency (TIA) before the end of the year. Delivering his budget speech in Parliament in May, Minister of Science & Technology Mosibudi Mangena said this agency would be designed to provide financial assistance to individuals or parties to enable them to develop and commercialise their technical innovations and inventions. "The agency will draw together and integrate the management of disparate technological innovation initiatives that are still at an early development stage."

It is also expected that the TIA will become a custodian of the Centres of Competence. "These centres arise from the need to actively promote greater collaboration between and among the academia, industry, research councils, entrepreneurs or technopreneurs, international research organisations, and individual inventors and innovators, such that this collaborative effort produces socio-economic benefits for the country," noted Mangena. "The Centres of Competence complement the Centres of Excellence we launched in 2004, which are focused mainly on basic research, knowledge production and publications."

Nelson Mandela Bay Eyes Groundwater Resources

SA Tourism

Groundwater has the potential to supply as much as 20% of Port Elizabeth's present water requirements, a recently published study has found.

A study into potential high-yielding aquifers around the Nelson Mandela Bay Municipality indicates that groundwater could potentially be exploited to augment the area's future bulk water supply. The municipal area's water requirements are estimated to increase from the present use of nearly 100 million m^3/annum to about 130 million m^3/annum by the year 2017, mostly as a result of the developments around the new Coega harbour and industrial development zone.

Traditionally, groundwater resources for municipal supplies are only assessed within a relatively small radius of cities or towns because of logistical and economical factors associated with pumping large distances. In the past groundwater was largely written off as a potential bulk water supply source to the city of Port Elizabeth and surrounds because previous assessments focused on a relatively small area in and around the city.

The latest study, supported by the municipality, the Water Research Commission, and the Department of Water Affairs & Forestry (DWAF), presents major aquifers and potential drilling target areas within an economically acceptable distance of existing water supply infrastructure. As the authors explain, the study applied the concept of an 'economic radius' rather than a 'physical radius' from the point of need.

"While this study focuses on the Nelson Mandela Bay Municipality, the concept of an economic radius should be applied to all municipalities – particularly those where existing bulk supply infrastructure stretches hundreds of kilometres from the town or city," write Ricky Murray of Groundwater Africa, Marc Goedhart of the Council for Geoscience and Jane Baron of DWAF. "The study aims to show that groundwater resources can be considered far from the point of use, so long as the area is within an acceptable distance from existing water supply infrastructure."

Prime groundwater development areas were identified and grouped into five hydrogeological domains. Within each of the domains specific groundwater exploration targets were identified and prioritised. Much of the information was based on previous work done for DWAF's Groundwater Resource Assessment Phase II project and no ground-truthing was done to verify the target areas.

"The purpose of this exercise was to provide a first-order estimate of the groundwater potential, and it should serve as a good starting point," the authors explain. "It is likely that some of the areas may be unsuitable for groundwater development for a variety of reasons, and that a number of other areas could also be developed for large-scale groundwater supply."

The study indicates that groundwater resources in the areas identified, if well developed, could yield about 30 million m^3/annum. With use and scientific monitoring, it would be possible to establish whether the upper estimates of 40 to 50 million m^3/annum could be attained on a sustainable basis. Present groundwater use is coarsely estimated to be about 9 million m^3/annum, which leaves about 20 million m^3/annum available for future development. More in-depth studies have been recommended.

To order the report based on the study (**Report No: TT 327/08**) contact Publications at Tel: (012) 330-0340 or E-mail: orders@wrc.org.za

Table: Total groundwater potential in all five hydrogeological domains

Groundwater Exploitation Potential (normal years)	48 Mm^3/a
Groundwater Exploitation Potential (dry years)	32 Mm^3/a
Borehole yield without artificial recharge and continuous abstraction	28 Mm^3/a
Borehole yield with artificial recharge and 6 month/a abstraction	41 Mm^3/a
Existing use	9 Mm^3/a

WATER DIARY 2

WASTE MANAGEMENT
OCTOBER 6-10
The 19th annual Waste Management Conference & Exhibition will take place at the Durban International Convention Centre. The theme is 'Minimising Waste and its Effects on Society'. *Enquiries: Ms Nina Freysen-Pretorius or Belinda du Preez; Tel: (031) 303-9852; E-mail: nina@confco.co.za or Belinda@confco.co.za; Visit: www.wastecon2008.co.za*

GROUNDWATER
OCTOBER 26-NOVEMBER 1
International Association of Hydrogeologists 2008 Conference with the theme 'Integrating Groundwater Science and Human Well-Being', will take place in Toyama, Japan. *Visit: www.lni.co.jp/iah2008*

New from the WRC

Report No: TT 328/08

Community-based Governance of Freshwater Resources in Southern Africa (S Pollard and T Cousins)

This research seeks to address issues regarding natural resource governance arising from field work in communal wetlands in the Sand River catchment of the north-eastern region of South Africa. Here the emerging confusion over changing roles and responsibilities for natural resources echoes wider concerns over land and natural resource tenure in communal areas. Despite the best intentions of policy reforms there appeared to be a 'muddying of the policy waters' with various actors claiming authority over the control and management of natural resources. Work in the Sand River catchment has highlighted that natural resources are generally managed according to locally-derived rules and norms, or a blend of local and statutory systems. The report concludes that locally-based systems are part of our constitutional landscape. Legal pluralism is a reality, and thus a more constructive approach to the apparent dilemma of legal pluralism is needed.

Report No 1476/1/08

Hydroclimatic variation over Southern Africa at Intra-annual and Inter-annual Time Scales with Special Reference to the Role of the Oceans (M Rouault; CJR Reason; N Vigaud; A Mavume and N Fauchereau)

Over the last century, South Africa has suffered from dramatic inter-annual changes in rainfall, characterised by severe droughts and wet spells. There is a need to enable resource managers (water and agriculture) to optimally exploit the best current climatological knowledge in dealing with hydroclimatic variability, thereby enhancing their decision-making ability for the short, medium and long term. This project set out to enhance the understanding of hydroclimatic variability in southern Africa with special reference to the role of the oceans and thereby address some of the needs of resource managers in this connection. Among others the project aimed to assess the suitability of indices used to represent hydroclimatic variation over southern Africa from a joint ocean/atmosphere system and water resource management perspective; and to select, assess and apply the most promising of advanced remote sensing and modelling products.

Report No 1611/1/08

A Survey of Information Exchange between Water Services Information Providers and Water Services Authorities/Local Government in South Africa (JP Pansegrouw and P Naidoo)

Water services information providers (including Water Research Commission, Department of Water Affairs & Forestry, CSIR, and Development Bank of Southern Africa among others) are responsible for the provision of relevant water services information to the various water services authorities (WSAs) and local government structures across the country. The study investigated the information exchange between these information providers and WSAs or local government bodies involved in the provision of water services in South Africa. It included a literature review, interviews with key stakeholders, surveys and case studies aimed at verifying the communication channels used in the water services sector. Among others the study found that more collaboration is required between water services information providers to avoid duplication, and stressed the importance of identifying the target audience clearly as well as the timing of dissemination or information exchange.

Report No: TT 347/08

Enabling Water Fluoridation on Small Drinking Water Treatment Plants (R Rajagopaul; P Thompson and A Hariram)

The project aimed to enable fluoridation to be done safely on small water treatment plants by means of the evaluation, selection and implementation of safe handling and dosing equipment and monitoring instrumentation. The outcome of the research indicated that the use of equipment that would ensure safety of handling and exposure to operations personnel and safety to the consumer by maintaining an acceptable fluoride dose in the drinking water is the main priority. A Web-based fluoridation user guide has been set up to provide online fluoridation information.

Report No: 1307/1/08

The Impacts of High Winter Flow Releases from an Impoundment on In-stream Ecological Processes (C Dickens; M Graham; G de Winnaar; K Hodgson; F Tiba; R Sekwele; S Sikhakhane; F de Moor; H Barber-James and K van Niekerk)

The Albert Falls Dam on the uMngeni River, in KwaZulu-Natal, provides an ideal system in which to test the impacts of downstream water releases on the river ecosystem. The particular system releases high flow volumes during the winter dry season and lower volumes during the summer wet season, thus exhibiting a reserved hydrograph situation. This project firstly set out to document the potential causes of downstream ecological stress, in particular the flow volumes and the quality of the water released from the dam. Following this was an investigation into the signs of stress that were being exhibited by the ecosystem. Investigation of the riparian vegetation, the fish and the invertebrates all revealed that while there were significant changes induced by the dam, these were rapidly ameliorated with distance downstream, probably due to the ingress of tributary water and the processes of purification that remove toxic substances from the water. The central conclusion of this project is that, while the quality and quantity of water released from the dam does no pose any obvious threat to the downstream river environment at a distance beyond a few kilometres, there are significant changes to the ecosystem, including its biodiversity.

To order any of these reports, contact Publications at Tel: (012) 330-0340; Fax (012) 331-2565; E-mail: orders@wrc.org.za or visit: www.wrc.org.za

Whisky used to clean polluted lands

Scientists have unveiled the latest weapon in the battle to clean up polluted groundwater at contaminated land site – whisky. A natural byproduct from the preparation of Scotland's national drink is reportedly being used to clean contaminated groundwater and wastewater in a pioneering technique, developed by scientists at Aberdeen University. Known as Dram (device for remediation and attenuation of multiple pollutants) the technology is said to be cheaper and easier to deploy than standard treatments, and has the potential to cut the UK's estimated annual spend on land remediation of £1,2-billion. The passive system involves inserting the organic material from whisky processing into the ground to attract solvents, which it breaks down. No intervention is required to apply it to contaminated sites as it can use existing infrastructure.

Harmful algae take advantage of global warming

The weather extremes accompanying global warming are enhancing the growth of cyanobacteria, according to a paper published in the April 4 issue of the journal *Science*.

Toxic algal blooms are found in key bodies of water across the world, and cost many million of Rands to treat. "It has long been known that nutrient runoff contributes to cyanobacterial growth. Now scientists can factor in temperature and global warning,"

said Prof Hans Pearl of the University of North Carolina who co-wrote the paper along with Prof Jef Huisman of the University of Amsterdam. "As temperatures rise waters are more amenable to blooms."

Warmer weather has created longer growing seasons, and it has enabled cyanobacteria to grow in northern waters previously too cold for their survival. Species first found in southern Europe in the 1930s now form blooms in northern Germany, and a Florida species now grows in the southeastern US. Others have appeared recently in places as far north as Canada.

Fish and other aquatic animals and plants stand little chance against cyanobacteria. The algae crowd the surface water, shading out plants – fish food- below. The fish generally avoid cyanobacteria, so they are left without food. And when the algae die they sink to the bottom where their decomposition can lead to extensive depletion of oxygen.

UN to assist African farmers

Some 10 000 farmers in five African countries, where crops are expected to be badly affected by climate change, are to receive help from the United Nations Meteorological Organisation (WMO) in the form of low-cost rain gauge equipment and roving seminars provided by agricultural experts.

With the help of Spain, WMO will distribute the rain gauges to volunteer farmers in Burkin Faso, Mali, Mauritania, Niger and Senegal, and train them in using rainfall data to plan sowing, fertiliser application and harvesting. The goal of the roving seminars is to support farmers' self-reliance by supplying them with information on weather and climate risk management.

In West Africa, the area suitable for agriculture, the length of the growing season, and crop yields, especially along the margins of arid and semi-arid areas, are all expected to decrease, according to projections by the UN Intergovernmental Panel on Climate Change. In some African countries, yield from rainfed farming could be reduced by up to 50% by 2020.

Biodiversity – it's in the flow of the water

A team of international researchers have invented a method for turning simple data about rainfall and river networks into accurate assessments of fish biodiversity, allowing better prediction of the effects of climate change and the ecological impact of man-made structures, such as dams.

The mathematics behind the new method can also be used to model and predict a range of other questions, from the transmission of waterborne illnesses to vegetation patterns on land adjacent to rivers. The researchers, who published a report in the May 8 issue of *Nature*, have created a computer simulation that allows them to predict, based on rainfall measurements and the structure of river networks, how many species of fish will occupy any given region.

"It is an extremely simple model, but it predicts well all of the characteristics of biodiversity that we were interested in," commented Prof Ignacio Rodríguez-Iturbe of the Department of Civil and Environmental Engineering at the University of Princeton, who lead the study. "Our model implies that water dynamics have a commanding effect on biodiversity in river basins."

For more information, go to www.princeton.edu/main/news/archive/S21/00/89G47/

Groundwater recharge system wins international award

The world's largest water purification plant for groundwater recharge will be awarded the prestigious Stockholm Industry Water Award during the 2008 World Water Week in Stockholm in August.

The Groundwater Replenishment System (GRS), situated in California, in the US, was developed through the Orange County Sanitation District with the Orange County Water District. It will provide enough water to meet the needs of an additional 50 000 people without diminishing groundwater resources for present of future generations.

The system diverts treated sewer water that is currently discharged into the ocean and purifies it through a series of advanced techniques including microfiltration, reverse osmosis, ultraviolet disinfection and hydrogen peroxide. The cleaned water is returned to the groundwater basin to increase both water supply and quality.

"Both agencies have demonstrated how communities can develop, implement and achieve sustainable water reuse," said Lars Gunnarson, chair of the Award Committee. "Their extensive involvement of private companies, long-term commitment to research and development, and utilisation of cutting-edge technologies has established a model for water-stressed regions to replenish groundwater resources and improve water security."

WATER ON THE WEB

http://groups.google.com/group/WatSanIEC/web
This is a collection of water and sanitation information, education and communication materials on water and sanitation from emergency response and development efforts throughout the world.

www.wrc.org.za/publications_education.htm
The Water Research Commission provides fact sheets on more than 20 different water-related topics, from alien plants, to groundwater and wetlands, to water scarcity and water cultures. The organisation's popular Career Guide, aimed at high school learners, is also available online. Lastly, a series of Lesson Plans on Water for Grade R to Grade 10 is available. The lesson plans were developed in collaboration with ShareNet.

www.connect2earth.org
A new online community for young people has been launched on the Web. Hosted by IUCN, WWF and Nokia, the website offers young people (under the age of 35) the opportunity to share their ideas about environmental issues and solutions. People can contribute by uploading their own videos, images and texts.

www.drinking-water-engineering-and-science.net
Anyone can read the articles on the new Drinking Water Engineering and Science journal for free – it is the author who pays for publication (about €400 for ten pages). Articles are subject to the usual peer review procedure of assessment by three referees. If an article is not published, it will be placed on the discussion section of the site so that it is still available to all.

WATER BY NUMBERS

- **91** – The number of clinics that had no access to basic water and sanitation which have now been supplied, according to the Department of Water Affairs & Forestry (DWAF).
- **20 000** – The targeted number of new water management devices the City of Cape Town hopes to install by mid-2009. The water management device is programmed to dispense a pre-agreed volume of water each day. This encourages consumers to analyse and monitor water usage and to avoid unnecessary wastage.
- **R6,69-billion** – The total budget for DWAF for 2008/2009.
- **19** – The number of megacities with more than ten million inhabitants, according to the United Nations. For the first time in history, the number of people living in cities this year outranks the number living in rural areas.
- **R415-million** – The funds budgeted by DWAF for the rehabilitation of bulk infrastructure for the present financial year.
- **1 831** – The number of interactions on transboundary basins (both conflictual and cooperative) over the last 50 years, according to UNESCO. A total of 7 conflicts have involved violence, and 507 conflictive events have occurred while about 200 treaties have been signed, with a total of 1 228 cooperative events.
- **€12-billion** – The sales generated in 2007 by Suez Environment, the environment arm of French utility group Suez. The unit reportedly makes 80% of its revenues in Europe and is the second biggest water player after Veolia.
- **222** – The number of informal settlements around the City of Cape Town, according to Mayor Helen Zille.
- **R872-million** – The monies allocated from Johannesburg City's budget to Johannesburg Water towards upgrading of the city's sewer networks and bulk wastewater infrastructure.
- **51** – The number of schools countrywide which have no basic sanitation.

Saving Water from 'Field to Fork'

The Stockholm International Water Institute (SIWI), the Food and Agriculture Organisation of the United Nations (FAO) and the International Water Management Institute (IWMI) have called on governments to reduce by half, by 2025, the amount of food that is wasted after it is grown.

The organisations have released a report, *Saving Water: From Field to Fork – Curbing Losses and Wastage in the Food Chain*, outlining concrete steps to achieve a 50% wasted food reduction.

LIKE LEAVING THE TAP RUNNING

Tremendous quantities of food are discarded in processing, transport, supermarkets and people's kitchens. This wasted food is also wasted water. In the US, for instance, as much as 30% of food, worth some US$48,3-billion, is thrown away each year. This is like leaving the tap running and pouring 40 trillion litres of water into the garbage can – enough water to meet the household needs of 500 million people.

More than enough food is produced to feed a healthy global population. Distribution and access to food is a problem – many go hungry, while others over-eat. The report highlights an often overlooked problem: we are providing food to take care of not only our necessary consumption but also our wasteful habits.

"As much as half of the water used to grow food globally may be lost of wasted," says Dr David Molden, Director of Research at IWMI. "Curbing these losses and improving water productivity provides win-win opportunities for farmers, business,

www.sxc.hu

ecosystems, and the global hungry. An effective water-saving strategy will first require the reducing food wastage is placed firmly on the political agenda."

Food production is constrained by the availability of water and land resources. An estimated 1,2-billion people already live in areas where there is not enough water to meet demand. And with rising demand for water-intensive agricultural products, such as beef and bioenergy, pressure mounts.

According to the Comprehensive Assessment of Water Management in Agriculture 2007, these trends will lead to crises in many parts of the world, particularly South Asia and sub-Saharan Africa. "Unless we change our practices, water will be a key constraint to food production in the future," noted Dr Pasquale Steduto of FAO.

SAVING WATER

Water losses accumulate as food is wasted before and after it reaches the consumer. In poorer countries, a majority of uneaten food is lost before it has a chance to be consumed. Depending on the crop, an estimated 15% to 35% of food may be lost in the field. Another 10% to 15% is discarded during processing, transport and storage.

In richer countries, production is more efficient but waste is greater: people toss the food they buy and all the resources used to grow, ship and produce the food along with it.

The report stresses that the magnitude of present food losses presents both challenges and opportunities. "Improving water productivity and reducing the quantity of food that is wasted can enable us to provide a better diet for the poor and enough food for growing populations," said Prof Jan Lundqvist of SIWI. "Reaching the target we propose, a 50% reduction of losses and wastage in the production and consumption chain, is a necessary and achievable goal."

The report outlines a number of attainable steps, such as supporting farmers with improved harvesting and food storage facilities; benchmarking standards for businesses to reduce waste in processing and transport; and educating consumers on the impacts of over-eating and food waste on water resources.

To access the report, go to www.siwi.org/documents/Resources/Policy_Briefs/Paper_13_Field_to_Fork.pdf

WATER DIARY 3

WETLANDS
OCTOBER 28-31
The 2008 Wetlands Indaba will be held in the Skukuza Camp of the Kruger National Park. The theme is 'Healthy Wetlands, Healthy People'. *Enquiries: Gavin Cowden, Tel: (013) 766-6062; E-mail: gcowden@mpg.co.za; Visit: http://wetlands.sanbi.org*

WATER FOR GROWTH & DEVELOPMENT
OCTOBER 29-31
The Ninth WaterNet/WARFSA/GWP-SA Symposium will take place in Johannesburg in association with the International Commission on Water Resources Systems.
The theme is 'Water and Sustainable Development for Improved Livelihoods'. The symposium promotes interaction among policymakers, academics, and practitioners.
E-mail: symposium09@waternetonline.org or Visit: www.waternetonline.org

Unsafe toilets making AIDS patients sick

The dilapidated and unhealthy state of many of the sanitation facilities in communities in peri-urban and rural South Africa is posing a health risk especially to those people suffering from deficient immune systems as a result of HIV/AIDS.

This is one of the main findings of an eight-month study funded by the World Health Organisation and the Water Research Commission in which several communities around the country were surveyed to provide insight into the extent to which water, sanitation and hygiene issues and practices are important and relevant for AIDS patients and their care-givers.

With regards to sanitation, the study looked at the presence of toilets, their accessibility (distance from homestead), and sanitation and hygiene practices. While most of the households surveyed had toilets, many of these were self-built pit latrines in very poor condition, with some in near state of collapse.

Distances of the toilets from the homestead ranged from 15 m to 40 m. This made them very difficult to be reached by weak patients, who had to battle the elements to reach them. In addition, many of the toilet entrances were very narrow, making it near impossible for care-givers to assist their patients.

Only 60% of the study households who had toilets said that they cleaned them regularly. The dirty toilets pose a health hazard especially to those suffering from HIV/AIDS, and many communities reported regular outbreaks of diarrhoea.

For a copy of the report (**Report No: KV 290/08**) contact Publications at Tel: (012) 330-0340 or E-mail: orders@wrc.org.za

Minister shocked at state of FS towns' wastewater treatment

Minister of Water Affairs & Forestry Lindiwe Hendricks has expressed her shock and outrage at the state of wastewater treatment at Matjhabeng Local Municipality in the Free State.

The minister visited the municipality, which comprises the towns of Welkom, Odendaalsrus, Virginia, Henneman, Allanridge and Ventersburg as part of National Sanitation Week, held during the last week of May. Poor sewage management has seen the discharge of raw sewage into pans in the municipal area for a number of years. At present, two of the municipality's largest wastewater treatment plants located at Welkom and Odendaalsrus are out of order and overflowing. The municipality is one of a number of local authorities in the Free State where the bucket system has historically been used.

According to Hendricks, her department did summons the municipality in October last year, but never got a response. She gave Matjhabeng 30 days to come up with an action plan on how they were going to tackle their sewage problem.

One of the challenges plaguing the municipality is its lack of technical personnel. There is reportedly not a single engineer employed at the municipality.

Bucket eradication projects already crumbling

Municipalities must find ways of ensuring their sanitation projects are sustainable. This was the message from Minister of Water Affairs & Forestry Lindiwe Hendricks at the launch of National Sanitation Week at the Sandton Convention Centre on 26 May.

"There have been too many instances where infrastructure has been inappropriate and unsustainable due to the lack of a holistic approach in delivering these services," she said. The minister particularly expressed her concern with some of the projects implemented under the bucket eradication programme where there is already evidence of operation and maintenance challenges caused by poor implementation practices.

Hendricks introduced a South African sanitation action plan based on the outcomes of the Second Africa Sanitation Conference held in Durban in February as well as several water summits held around the country since 2005. The plan, which was to be submitted to the African Ministerial Council on Water in June, aims to accelerate the delivery of sustainable sanitation services.

Among others the action plan commits stakeholders to aim to spend 0,5% of GDP on sanitation. Hendricks said her department would call on the sanitation budget in the municipal infrastructure grant to be ring-fenced so as to ensure enough funds to sanitation projects.

She also called on provincial leaders to raise the profile of sanitation and hygiene in South Africa and recommit themselves to ensuring access to safe sanitation to all the country's citizens. "People still do not like to talk about such matters. It is our duty as stakeholders to make more noise around sanitation issues and thereby raise the profile and make an impact," Hendricks said.

Since 1994 almost 11 million more people have benefited from government's sanitation programme.

Harties residential estate opts for ozone-treated water

Locally-owned water quality treatment firm Purion has developed and delivered a domestic water treatment plant to another luxury residential estate near Hartbeespoort Dam, in the North West Province.

The 600 kℓ/day high-quality drinking water plant makes use of the company's propriety Safewater system, which uses in-house developed ozone generators to treat water from, in this case, a number of boreholes on site. According to Terry Featherstone, Chairman of the Governing Body at The Coves, it was decided to use the ozone-based water treatment plant as a result of the deteriorating quality and quantity of the groundwater supply. "In the event that we can no longer make use of groundwater, we will be able to treat water directly from the Hartbeespoort Dam."

The Coves Lifestyle Estate makes use of a stop/start system, i.e. water is treated to fill the on-site reservoir which holds a 24-hour supply. Once the reservoir is filled, the operation is stopped. Once the reservoir is empty, water treatment starts again.

Purion Technical Director Dr Rian Strydom is confident that the company's locally designed and manufactured and supported water treatment system can treat any type of water, both from surface and underground as is the case with another installation at the Roodeplaat Dam. The Safewater system is scalable and custom designed for hotels and large resorts, residential and golf estates, mines and industrial estates, municipal water treatment works, hospitals, and commercial complexes.

The turnkey system takes water directly from the source. Depending on the source of water, the system is equipped with an advanced dissolved air flotation (DAF) system to flotate material, such as algae, before ozonation.

Following ozonation, using the in-house developed and manufactured ozone generators and air preparation systems, the detoxified water finally runs through a granular activated carbon bed where all remaining organic compounds and the residual ozone are adsorbed.

Upon plant commissioning and handover, user or owner training is provide together with operating and maintenance options and dedicated 24/7 technical support of the installation.

"Ozone is a vastly superior disinfectant to chlorine, disinfecting around ten times more effectively", maintains Dr Strydom. "It remains the only real option to deactivate certain resistant viral strains, as well as parasitic species including *Giardia* and *Cryptosporidium*."

Ozone is a powerful oxidiser, which means that it will destroy many chemical molecules, or change them to more benign forms to enable safe discharge or supply of water. This includes endocrine disrupting compounds and personal care products now being detected in many water supply networks.

At present, Purion supplies this technology mainly to residential, industrial and mining sectors. The core technology also assists cooling water users to lower raw water demand volumes, eradicate chemicals and serve as a powerful anti-scaling agent in these closed systems.

Within the South African context, this locally-developed biotechnology offering now makes it feasible for districts and municipalities to adopt a decentralised, point-of-use treatment strategy to alleviate delivery pressure on traditional water services providers, reports Purion Executive Director Hawie Viljoen. "As a result of the lifecycle cost benefits of using a renewable resource (air) in our Safewater, Safewaste (for effluent disinfection) and Safecool ozone systems, it has now become commercially viable in South Africa to adopt this superior level of oxidation and disinfection at most localities throughout the country. This is the result of applying the locally-developed technology, which is much more cost-effective than imported systems, primarily as a result of the Rand-based and highly transparent cost of local technical support."

Ecologically, it introduces a new era by breaking the cycle of perpetual chemical dozing of water and the associated carbon footprint of manufacturing, transporting, storing and dozing, while at the same time delivering water quality of unprecedented safety to communities and estates.

"In addition, the application of these ozone technology solutions are increasingly being adopted as water security risk mitigation strategies, where ground and surface water resources of whatever quality can lawfully be utilised," concluded Viljoen.

Pump range turns 60

Denorco's Mono range of industrial pumps celebrates its sixtieth anniversary in South Africa this year.

The progressing cavity technology that is at the heart of the range of positive displacement pumps has successfully partnered South African agriculture and industry since 1935. The range has proved to be popular with the mining, petrochemical, chemical, pulp and paper, sugar, wastewater, food and beverage, pharmaceutical, agricultural and irrigation sectors.

"To this day, the Mono range of pumps is the benchmark for progressive cavity pumps in South Africa, where versatility and reliability are essential. Denorco continues to grow the sales of this highly regarded brand, and we see a great future for the range in time to come," said Denorco product manager Steven Rose.

SA firm concludes Madagascan weir contract

SSI Engineers & Environmental Consultants has almost completed the construction phase of a multimillion Rand contract awarded by QIT Madagascar Minerals in Madagascar.

The South African company's services have included a water resources study for the mine, detailed design and supervision for a salinity control weir, bulk water supply and wastewater treatment design for the mine and its residential villages, a landfill design, preparation of the water management plan and a stormwater management plan for the quarry.

Construction of the salinity control weir was scheduled for completion in June, ahead of the first production of ilmenite (titanium dioxide) from the mine, expected in late 2008. The weir project was initiated to prevent sea water flowing back up the Anony River into Lake Ambavarano, the main water source for the mining operation.

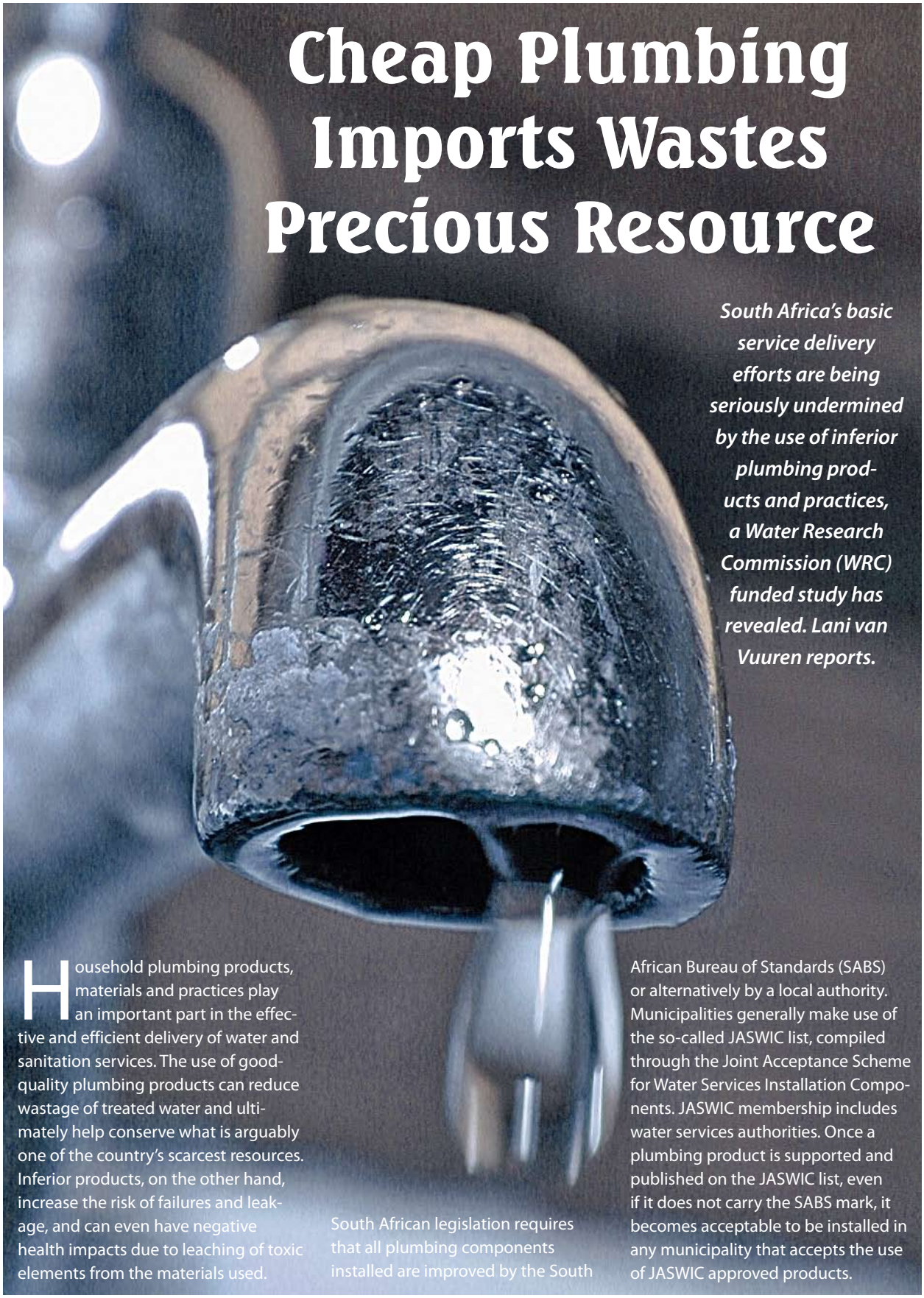
"One of the main objectives for the weir was to limit any increase upstream flooding – a critical issue in a coastal location with high storm frequency," reports SSI's Abhijatri Robinson. "We also had to optimise the height of the spillway by balancing the increased flooding versus the risk of overtopping from downstream initiated by wave, pressure and wind induced storm surge and the corresponding high tides."

Robinson notes that the detailed design of the weir's rockfill embankment was also a challenge as it needed to be constructed on a sand foundation in a very remote area.

The option selected could be constructed from local materials – rockfill flanks and a fine sand core – with no coffer dams by carrying out critical underwater work during the three-month drier season."

Cheap Plumbing Imports Wastes Precious Resource

South Africa's basic service delivery efforts are being seriously undermined by the use of inferior plumbing products and practices, a Water Research Commission (WRC) funded study has revealed. Lani van Vuuren reports.



Household plumbing products, materials and practices play an important part in the effective and efficient delivery of water and sanitation services. The use of good-quality plumbing products can reduce wastage of treated water and ultimately help conserve what is arguably one of the country's scarcest resources. Inferior products, on the other hand, increase the risk of failures and leakage, and can even have negative health impacts due to leaching of toxic elements from the materials used.

South African legislation requires that all plumbing components installed are improved by the South African Bureau of Standards (SABS) or alternatively by a local authority. Municipalities generally make use of the so-called JASWIC list, compiled through the Joint Acceptance Scheme for Water Services Installation Components. JASWIC membership includes water services authorities. Once a plumbing product is supported and published on the JASWIC list, even if it does not carry the SABS mark, it becomes acceptable to be installed in any municipality that accepts the use of JASWIC approved products.

Unfortunately, South African legislation does not explicitly prohibit the importation and sale of non-compliant products. Over the last few years this has resulted in the local market being flooded with cheap, often pirated products, especially from Asian countries.

This state of affairs, in addition, to concerns over deteriorating quality of workmanship and a lack of capacity to regulate the sector, prompted the WRC to launch an investigation into the state of the South African plumbing industry. The two-year research project was undertaken by the University of Johannesburg (UJ) in partnership with the University of the Witwatersrand.

FLOODED MARKET

During the two-year study, 2 626 plumbing products, ranging from valves, to taps and cisterns, were evaluated for compliance. A total of 58% were found to be non-compliant, i.e. they were neither SABS approved nor appeared on the JASWIC list.

Valves showed the lowest level of compliance (17%) while taps showed the highest (48%). In addition, 10% of products claimed to be SABS mark holders while they were, in fact, not included in the SABS list of mark holders.

"When you go into a hardware store, chances are you will find it much easier and cheaper to purchase a non-compliant plumbing component than a compliant equivalent," reports Prof Kobus van Zyl, Rand Water Chair in Water Utilisation at UJ and project leader on the WRC study. "These products are squeezing out local manufacturers all the while consumers are largely unaware with the problems associated with applying these products." Regulation proved to be a big challenge. Only the City of Cape Town has dedicated water inspectors.

WASTED RESOURCE

Inferior products are increasingly finding their way into basic service delivery developments. The project team visited several low-cost housing schemes around Gauteng to inspect their plumbing fittings. It was found that less than 10% of the fittings displayed the SABS mark.

"The general lack of quality of the products was reflected in the fact that more than half of the fittings inspected were broken or leaking. Also 50% of the toilets were leaking," notes Prof van Zyl. "This is despite the fact that the average age of the low-cost houses visited was less than two years."

"When you go into a hardware store, chances are you will find it much easier and cheaper to purchase a non-compliant plumbing component than a compliant equivalent."

Low-cost housing is supplied to poor people, who cannot afford to replace faulty plumbing or pay large water accounts due to leakage. "We should be fitting high-quality products that will operate with minimum maintenance for several years, rather than saddling poor communities with cheap, inferior products which contravene South Africa's legislative requirements," says Prof van Zyl.

A similar investigation was undertaken in 21 rural villages in the Upper Nwanedi Basin in Venda. The area is served by 108 public standpipes, with one or two taps serving between 4 and 30 households each.

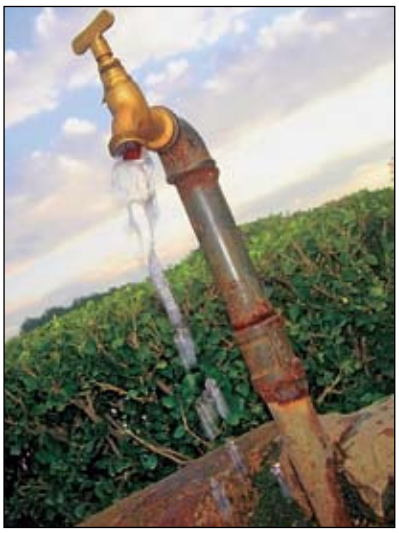
Despite having a dedicated maintenance officer several problems were observed, including broken handles, stripped heads on valves spindles, leaking gland seals and worn washers. (It was found that the maintenance officer lacked some basic tools to perform his work.)

Of the 108 standpipes, only 45% had SABS approved taps, 41% had non-compliant taps and 13% had no taps at all. The maintenance officer does not purchase taps or tap components himself. Thus, the local water services authority is directly responsible for the large fraction of non-compliant fittings.

"The tap is the most important component of a standpipe installation, and has to be exceptionally robust to withstand the high wear and tear due to frequent

MAIN FINDINGS OF THE WRC FUNDED STUDY

- Nearly 60% of plumbing products are not SABS or JASWIC compliant.
- Nearly 40% of plumbers surveyed considered leakage from plumbing components to be a large or very large problem, with toilet cisterns identified as the main contributor, followed by taps, geysers, pipes and other valves.
- Plumbers and product manufacturers considered a lack of enforcement of legislation due to a lack of trained inspectors as the biggest problem in the sector at present.
- The installation of non-compliant products seems to be a particular problem in new installations and less of a problem in renovations and maintenance.
- There is a high percentage of application of non-compliant products in rural water supply schemes leading to continuous leakage and unusable standpipes.
- Less than 10% of plumbing products surveyed in low-cost housing schemes showed the SABS mark.



The tap is the most important component of a standpipe installation and has to be exceptionally robust to withstand the high wear and tear.

Non-compliant plumbing products can lead to unnecessary leakage and wastage of water.

"A beautiful structure of size is still more important than the materials which go into it. The most important element, namely the user and his convenience, is still largely ignored."

use, occasional abuse and vandalism," notes Prof van Zyl. "Even the best taps would have a considerably lower working life than other components in the supply system." The project team therefore stresses the importance of a systematic procedure for maintenance and replacement of taps in rural supply systems.

INFRASTRUCTURE FOCUS

According to WRC Director Water Use and Waste Management Jay Bhagwan, the results of the study are not surprising, and confirm many concerns and suspicions. "The plumbing sector is poorly managed and regulated, which is why it has become the dumping ground for so many non-compliant products. We have also discovered that there is a lack of synergy between different legislations and national departments' responsibilities, which is allowing the situation to escalate."

Bhagwan believes that one reason for the high percentage of non-compliant fittings found in basic service delivery developments is that too much emphasis is still placed on the bulk infrastructure aspects of such projects. "In housing, for example, a beautiful structure of size is still more important than the materials which go into it. The most important element, namely the user and his convenience, is still largely ignored."

The use of a cheap import, which is guaranteed to fail within a few weeks will have huge repercussions on the functioning of a water supply system, notes Bhagwan. "Similarly, in our drive for efficient water use very little is achieved when the cheapest, inefficient devices are used in basic service delivery."

Unfortunately there are still unscrupulous contractors who merely get involved in basic services development contracts to 'make a quick buck'. "These contractors are rarely caught or held responsible when a cheap tap fails within the first week. It is also the item totally neglected by site engineers," says Bhagwan.

It is believed that this study has uncovered what may be a much larger problem, and the project team has called for a full-scale, national, investigation into the state of plumbing fittings in low-cost housing developments. "We cannot allow the most vulnerable people in society to be exploited in this way. The WRC will continue to fund new research to not only expose bad practice, but find practical solutions to these challenges," reports Bhagwan.

At the time of going to press the final report on the state of plumbing in South Africa was being published.

TABLE 1
Compliance of plumbing products found

Plumbing components	Compliant products		Non-compliant products	
	Number of	Fraction	Number of	Fraction
Valves	6	17%	30	83%
Bidets	78	27%	194	71%
Showers	136	36%	247	64%
Cisterns	23	37%	40	63%
Geysers	13	37%	22	63%
Pipes	216	43%	281	57%
Taps	672	48%	698	52%
Total	**1114**	**42%**	**1512**	58%
Grand total	**2 626**			

THE WATER WHEEL

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VAAL DAM – Underlying Gauteng's Wealth

Lani van Vuuren

The wealth of South Africa's economic powerhouse, Gauteng, was not only built on the backs of the mineworkers who have toiled in it gold mines for more than a century, but on the supply of water, which made economic growth at all possible. Lani van Vuuren reports on the history of the Vaal Dam, which remains one of the province's main sources of bulk water supply.

The outbreak of two World Wars saw massive bursts of secondary industrialisation taking place on the Witwatersrand, and with it an exponential growth in population. This resulted in an insatiable demand for water. Between 1915-16 and 1921-22 the number of industrial establishments in and around Johannesburg more than doubled from 862 to 1760.

With Johannesburg being one of the few large cities in the world not built on a large river, the Rand Water Board looked to the nearby Vaal River to meet the growing demand, constructing the Vaal Barrage in the early 1920s. Soon, however, this proved not to be enough to meet the users' growing water needs.

The Rand Water Board reached the limits of its abstraction rights in the early 1930s around the same time as the government was planning to build a dam at Christiana to provide water for the Vaalhartz Irrigation Scheme. After much debate, it was decided instead to build a dam at the confluence of the Wilge and Vaal rivers about 56 km south of Johannesburg, near Vereeniging.

The dam was to be a mass gravity concrete structure 518,6 m long, with a

height of 31,14 m above the mean river bed level and an earth embankment on the Transvaal (now Gauteng) side or right bank of the river, 1 890 m long.

The water board entered into a partnership with the South African government whereby it would secure 315 million litres per day from the Vaalbank Dam (as it was then known) and would contribute R3,3-million of the total R2,3-million cost. The Vaal River Development Scheme Act was subsequently passed in 1934.

RELIEVING UNEMPLOYMENT

The relief of unemployment, specifically among the white population, was an important consideration for the dam's construction. In fact, it was as a direct result of the Department of Labour's request on 31 March 1933, amidst the Great Depression, that public works be expedited to employ more white labourers that construction of the dam, along with the Vaalhartz Irrigation Scheme and the Loskop Irrigation Scheme began.

Government's main interest in the dam was to provide irrigation to the Hartz River Valley Afrikaner community in the Northern Cape. Nearly half of the dam's capacity, much of which evaporated along the way, was devoted to this idealistic project. The rest would be channelled to the Witwatersrand and finally resolve Rand Water's water shortage.

Many so-called 'poor whites' were employed on the scheme. Director of Irrigation, AD Lewis, stated in his annual report in 1934/35 that "in furtherance of the policy of employing European labour only, this work is also being carried out by means of white labourers." These labourers were between the ages of 18 and 45 and unmarried. The pay was two shillings per day, with a bonus of one shilling 6d per day worked. Interestingly enough, their bonuses were paid into a Post Office Savings Bank account, and they were only allowed to draw the money after they left the work. Money could be paid to dependents via a stop order.

"The relief of unemployment, specifically among the white population, was an important consideration for the dam's construction."

About 800 men worked on the construction of the dam. Notwithstanding this, in 1935 the Department of Labour found it impossible to keep the white labour force "up to the required strength, and it became necessary to employ natives on certain sections of the work." The reason for this, according to Lewis, was "the increased prosperity of the country and the consequent demand for labour."

In 1938, work on the superstructure of the Vaal Dam was completed, and a superintendent and small staff were appointed for maintenance purposes. On 13 December 1938, the dam overflowed for the first time. At that stage the dam had a full supply capacity of 994 million m^3.

Lewis noted in his report for the period 1938/39 that "the dam's usefulness as a regulator of the Vaal River flow has now been amply demonstrated and, although the year was admittedly a good one as

THE GREAT DEPRESSION AND THE POOR WHITE ISSUE

DWAF

The Great Economic Depression of the 1930s did not bypass South Africa. It struck the country in two waves – the crashing of Wall Street in 1929 and Britain abandoning the Gold Standard in 1931.

To compound matters the country was gripped in one of the worst droughts in living memory. Rains failed completely in 1931 and 1932 leaving crops to wither and farm animals to die in their dozens of starvation.

In the areas where farmers chose to stick it out black labourers were laid off in their thousands. They were forced to seek work in towns where they eked out a living as manual labourers and mine workers.

Many white farmers also abandoned their farms, seeking refuge in neighbouring towns. Interestingly, the daughters were often sent to town first to look for work. This was because their labour was not essential to keep the farm going as, for example, the labour of black women to their homesteads. In addition, women earned less than men and generally found work easier.

Due to the priorities of the government at the time it was never recorded how many black people suffered due to the Depression. But by the 1930s, 300 000 out of a population of 1,8 million whites were poor. Ninety percent of them were Afrikaans speaking. They became known as the 'Armblankes' or the 'poor whites'.

Many laws were passed by the South African government to address the Poor White issue. Jobs were reserved on the railway and postal service, the police and defence force for whites. Industrial schools were set up to train poor white children to be skilled workers. Jobs were also provided through a series of irrigation schemes.

A scheme for subsidised housing was also introduced. By the 1940s the living standards of most whites had improved substantially.

regards water supply, it is clear that the reach between the dam and the Vaal-Hartz Weir will be vastly improved both in the increase of the winter minimum flow, and the reduction in the magnitude of floods."

"After World War II, because of the rapid expansion in industrial activity and development of the Free State goldfields, it was decided that the Vaal Dam be raised by 6,1 m to make additional supplies of water available."

During the construction of the Vaal Dam, a small village named Deneysville after Deneys Reitz, who was Minister of Irrigation at the time of the dam's construction, was founded. Today, it is the centre of activity for the marinas and boating facilities that hug the shore of the dam.

VAAL-HARTZ SCHEME

The second component of the Vaal River Development Scheme – the Vaal-Hartz distribution works was also constructed using manual labour. As in the case of the Vaal Dam only single white males were used.

Modern machinery was also employed due to the extensive nature of this project. By the end of 1937 the Department of Lands settled 30 farmers on the scheme to work the land. This number increased to 126 in 1938. By March 1940, there were 304 settlers on the scheme.

VAAL DAM BETTERMENTS

After World War II, because of the rapid expansion in industrial activity and development of the Free State goldfields, it was decided that the Vaal Dam be raised by 6,1 m to make additional supplies of water available. This comprised raising the concrete overspill crest by 3,05 m and installing 60 crest gates 2,05 m high on top of the concrete. The earth embankment was also raised.

Work started in 1952 and was completed in 1956. The raising increased the storage capacity to 2 330-million m^3, which increased the dependable yield to 1 029-million m^3 a year. The cost of raising the dam was R2,9-million.

Lani van Vuuren

The Vaal Dam has 60 crest gates, each capable of releasing 115 m^3/s.

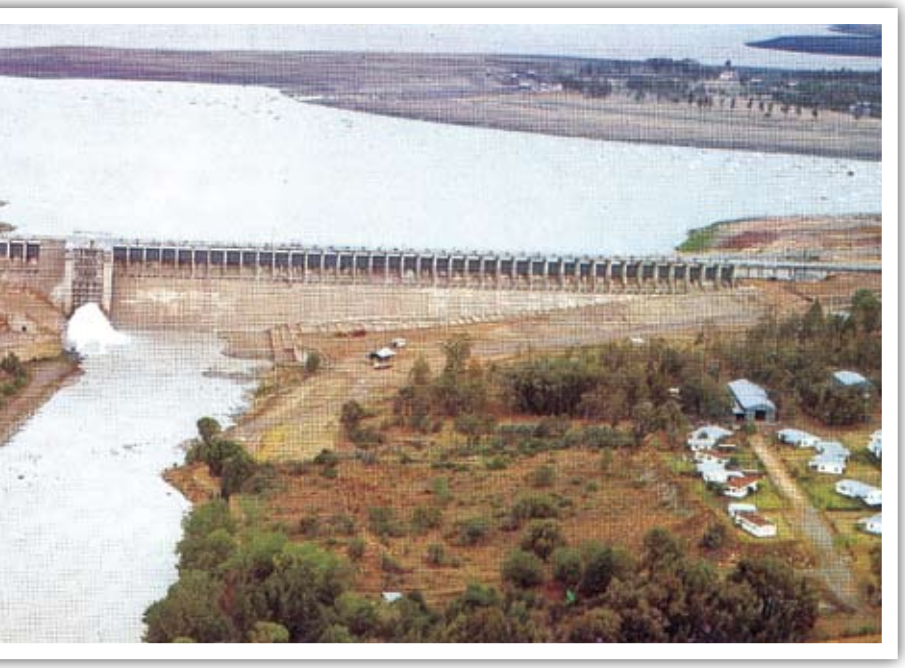
DWAF

Vaal Dam as seen from the air.

To better control floods, the gate height was increased by 1,82 m. This was done by adding a bottom extension to the existing gates. Furthermore, it was proposed that a pilot channel be provided through the saddle dam embankment. This saddle dam is situated on the Gauteng side of the Vaal River.

If this pilot channel were not installed a flood could breach the saddle dam and cause extensive damage to the undeveloped valley below the dam. Provision was also made for foundation drainage to uplift the dam wall itself. This was to improve the stability of the concrete wall, and was done by providing a foundation drainage tunnel in the foundations below the dam wall. This tunnel is 600 m long and a vertical curtain of drainage holes was drilled between the tunnel and the foundation line.

The stability of the concrete wall was also improved. Tensile stresses on the upstream face were decreased through the installation of pre-stressed cables. A total of 320 cables along the crest, 2,8 m from the upstream face, were installed. Each cable reaches from the crest to a maximum of 25 m below foundation level. New



FACTS & FIGURES ABOUT THE VAAL DAM

Capacity: 2,57 billion m³.
Shoreline: 880 km.
Dam surface area: 32 107 ha.
Number of crest gates: 60, each capable of releasing 115 m³/s. During high floods this can increase to 202 m³/s.
Number of provinces that make up the shoreline: Three (Free State, Mpumalanga and Gauteng).
Dam catchment area: 38 500 km².

hoisting structures and hoisting gear capable of raising the gates completely clear of the bridge deck were also installed.

In 1979, the Department of Water Affairs proposed to raise the dam wall to 3,05 m. This was to increase the capacity of the Vaal Dam by 1 033,5 million m³ to 3 364-million m³. It was proposed that 1,1 m of this raising be used for supply storage and the rest for flood storage. In this way, it was possible to store for consumption an addition 342 million m³ of water. This second raising took place in 1985.

The flood attenuation properties of the dam were severely tested in February 1996 when the largest flood ever recorded at the Vaal Dam site was experienced. An inflow of over 4 700 m³/s was measured into the Vaal Dam, which was already at full capacity due to good rains.

Full supply capacity was reached on 19 February 1996, i.e. only 194 million m³ of flood absorption capacity remained before the full inflow would have had to be released causing major damage. During the period from 15 December 1995 to 15 March 1996 the inflow volume to the dam was estimated at 7 605 million m³ – enough the fill the dam three times over. The inflow peak was estimated to have a return period of 70 years, while the outflow peak was estimated to have a return period of only 20 years.

Today, the Vaal Dam still forms the central storage reservoir for the Vaal River water supply system, which supplies water to Gauteng and surrounds.

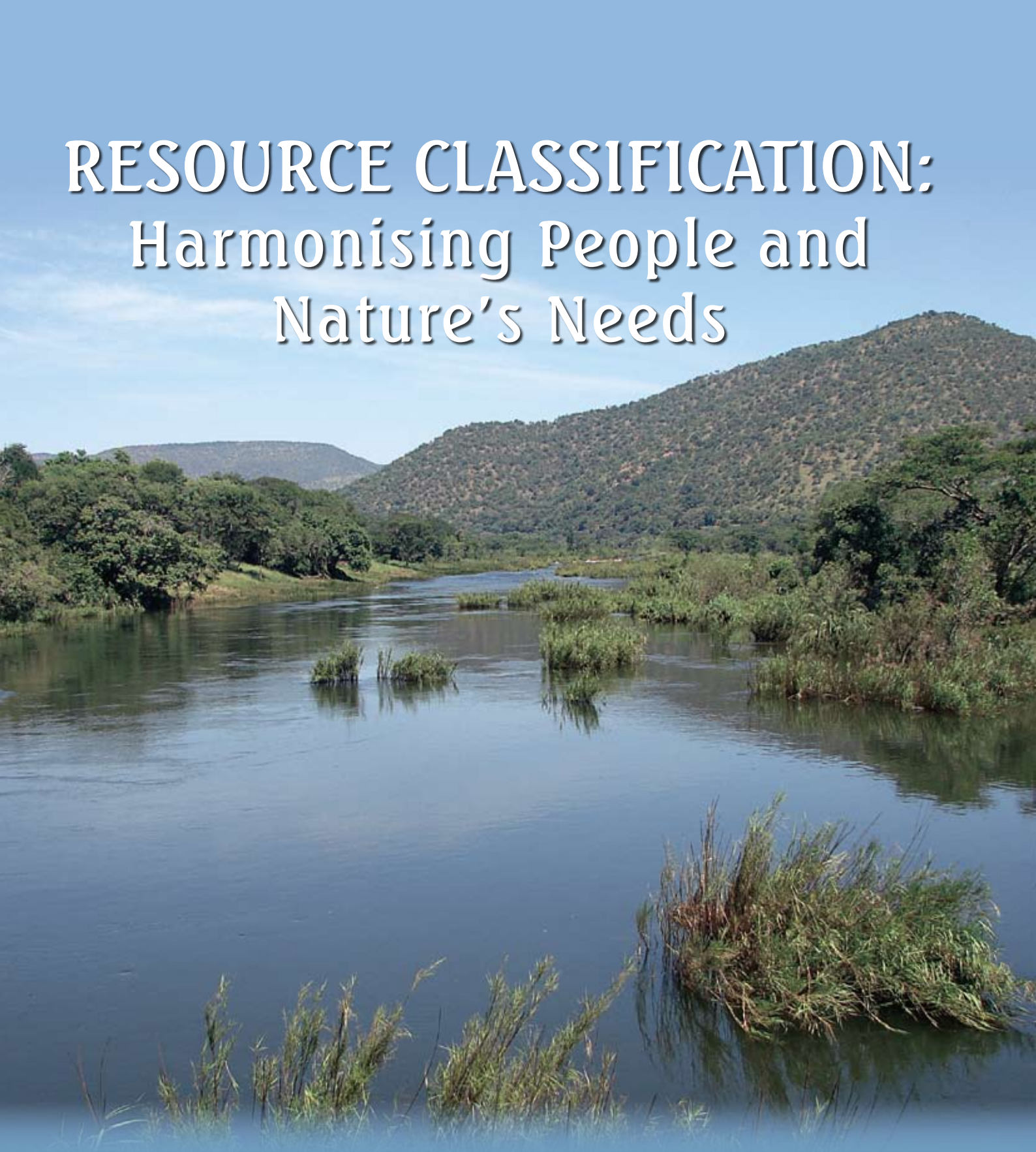
SOURCES

Hydropolitical History of South Africa's International River Basins (**WRC Report No**: **1220/1/04**)
Rand Water – A Century of Excellence, 1903-2003 (Phil Bonner & Peter Lekgoathi)
www.randwater.co.za
www.dwaf.gov.za

Lani van Vuuren

The Vaal River downstream from the Vaal Dam. The dam is unique in that three provinces make up its coastline (Free State, Mpumalanga and Gauteng).

RESOURCE CLASSIFICATION: Harmonising People and Nature's Needs



The need for a fundamental change in South Africa's approach to water management is largely underpinned by the country's Constitution. The Department of Water Affairs & Forestry (DWAF) is in the process of gazetting a water resources classification system (WRCS), viewed by many to be a revolutionary approach to give effect to integrated water resources management, writes Harrison Pienaar, DWAF Chief Director: Resource Directed Measures.

At present, DWAF is confronted by various challenges: the infinite nature of water resources; redressing past imbalances in water allocation and ensuring equity between generations simultaneously; aligning water resource management with water services provision; combining surface and groundwater resource quality; and applying resource directed measure methodologies to surface and groundwater resources comprising highly variable characteristics to name but a few.

WRCS is a set of guidelines and procedures for determining the different classes of water resources. It is a serious attempt towards harmonising the ecological sustainability of water resources with social and economic needs. The system is therefore aimed at recommending a normative desired condition for each water resource in a particular catchment.

According to Section 12 of the National Water Act (NWA) the Minister must prescribe a system for classifying water resources. This requires gazetting the WRCS. The gazetted WRCS will provide a definition of the classes that are to be used and the procedures to be followed to recommend a class.

The NWA requires that the WRCS be gazetted for comments for at least 60 days. All comments received will be recorded and considered. The National Assembly and National Council of Provinces may require information on how particular comments are addressed. As soon as reasonably practical after the Minister has prescribed a system for classifying water resources, he or she must, subject to subsection four of the Act, by notice in the Government Gazette, determine for all or part of every significant water resource:

- A class in accordance with the prescribed classification system; and
- Resource Quality Objectives (RQOs) based on the determined class.

Important principles have been developed during the country's water law

"The water resources classification system is a serious attempt towards harmonising the ecological sustainability of water resources with social and economic needs."

reform process, with the following extracted principles strongly considered when embarking on the development of a water resources classification system:

Principle 2 – which recognises the fact that all water is linked in the hydrological cycle, with all water having consistent status in the law, irrespective of where it exists within that cycle;

Principle 5 – in a relatively arid country such as South Africa, it is necessary to recognise the unity of the water cycle and the interdependence of its elements, where evaporation, clouds and rainfall are linked to groundwater, rivers, lakes, wetlands and the sea, and where the basic hydrological unit is the catchment;

Principle 7 – which states that the objective of water management is to achieve long-term environmental sustainability with social and economic benefit to accrue for the overall benefit of society; and

Principle 26 – which links the regulation of water services to broader local government frameworks.

CONTEXTUALISING THE WRCS

The desired characteristics of the resource are represented by a management class. The economic, social and ecological implications of choosing a management class will need to be established and communicated to all interested and affected parties during the classification process.

The outcome of the classification process will be the setting of the management class and RQOs by the Minister or her/his delegated authority for every significant water resource (i.e. river, wetland, estuary, and aquifer). This will be binding on all authorities or institutions when exercising any power or performing any duty under the NWA.

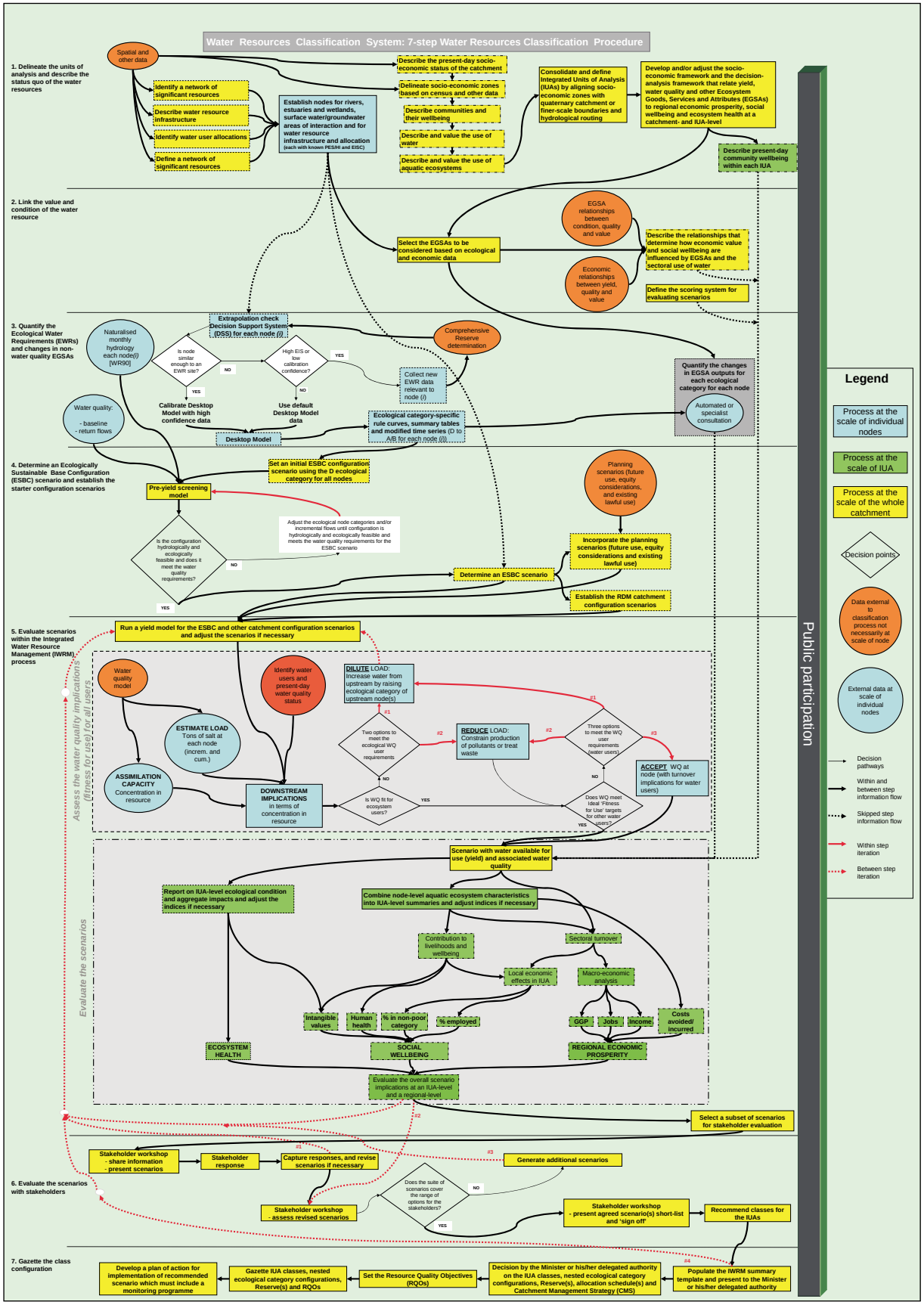
This management class essentially describes the desired condition of the water resource and along with that the degree to which it can be utilised. In other words, the management class of a water resource sets the boundaries for the volume, distribution and quality of the Reserve and RQOs, and thus the potential allocable portion of a water resource for off-stream use. This has considerable economic, social and ecological implications.

PROPOSED STEPWISE WATER RESOURCES CLASSIFICATION PROCEDURE

The seven major steps are mostly followed in sequence, although where feasible, some of the steps can be done in parallel. In the **first step**, the team responsible for classifying the catchment(s)' water resources begins by identifying and describing all potential water resources and all existing lawful water users, and then develops a representation of the catchment as a simplified network of spatial management units. Each of these management units is represented by a modelling 'node'. The nodes are grouped into sub-regions called integrated units of analysis on the basis of social, economic and hydrological similarity.

The **second step** defines methods for linking different water use scenarios within a region to the social well-being of the people who live there, the region's economic prosperity and the overall health of its ecosystems. Steps 1 and 2 occur in parallel for most catchments.

The **third step** involves quantifying the volume, distribution and timing of



Proposed stepwise classification procedure.

categories of ecological water requirements at each of the nodes identified in Step 12. In order to provide the information needed in Steps 4 to 6, flows are calculated for four increasing levels (or categories) of ecological sustainability at each node.

In the **fourth step**, a set of about six to ten different scenarios are developed which capture a range of possible future desired conditions for the catchment's water resources. This is followed in **step 5** by guidelines for evaluating the economic, social and ecological implications of each of these scenarios.

Although stakeholders are involved throughout the water resources classification process, they play a more prominent role in **step 6**. Accordingly, this step provides guidance for stakeholder consultation regarding the scenarios and their implications. **Step 7** then allows for the final selection of an overall catchment configuration of classes by the Minister. When published in the Government Gazette, this decision about the desired condition of water resources in the catchment becomes legally binding.

HARMONISING ECOLOGICAL SUSTAINABILITY WITH SOCIAL AND ECONOMIC GOALS

In recent years following the development of welfare economics and ecological, environmental and resource economics, three main policy goals for integrated water resource management have emerged: efficiency, equity and sustainability. The economic goal for efficiency relates to maximising economic returns from water resources, or achieving the greatest possible net benefit. This can also be seen as fulfilling the goal of economic development.

The social goal of equity is to ensure that the economic benefit derived from utilising water resources, and the costs incurred in water supply development, are distributed fairly. In South Africa, this needs to be done in the context of the legal imperative of reducing poverty and redressing historic inequities.

The goal of ecological sustainability recognises the limits to resources in the light of population growth and economic development. It thus promotes the use of resources in such a way as not to compromise the economic opportunities and social well-being of both present and future generations. Ecological goals may also include meeting national and international biodiversity conservation obligations as well as ensuring an acceptable state of health of resources in the short and long term.

However, these economic, social and ecological goals are potentially conflicting and are not easy to solve simultaneously. A number of trade-offs will therefore have to be considered in the classification process that will require a suitable, integrated analytical and decision-making system (i.e. the WRCS).

The following guiding principles were identified for the evolving WRCS to help make the classification process open, transparent and reasonably predictable, and to help reduce the level of potential contestation:

Principle 1 (Balance and trade-off for optimal use): The chosen management class should balance protection of the resource with its utilisation in line with societal norms and values. Utilisation of the resource provides economic and social benefits. It also has the potential, however, to compromise ecosystem integrity, which has economic and social costs. This balance will require trade-offs. The WRCS should therefore clearly outline the implications of different management classes to facilitate informed decision-making.

Principle 2 (Sustainability): The principle reason for the protection of water resources is to maintain ecosystem integrity at a level which ensures the continued delivery of desired ecosystem goods, services and attributes for use. The WRCS therefore needs to provide a framework to help facilitate the sustainable use of water resources. It is also recognised that there is a sustainability baseline that if crossed could result in the non-delivery of the goods, services and attributes necessary for economic growth, poverty alleviation and the redress of historical inequality.

"The outcome of the classification process will be the setting of the management class and RQOs by the Minister or her/his delegated authority for every significant water resource (i.e. river, wetland, estuary, and aquifer). This will be binding on all authorities or institutions when exercising any power or performing any duty under the NWA."

Principle 3 (National interest and consistency): A management class may produce solutions that are acceptable at a local level, but are sub-optimal when considered at a national level. Catchment-level decisions therefore need to be evaluated against national-level interests (and, where appropriate, international-level constraints, for example, international obligations). The WRCS should also outline a clear intention with respect to the characteristics of different management classes and provide for consistency in this regard.

Principle 4 (Transparency): Stakeholders should be consulted both in the development of the WRCS and in the process of classifying the nation's water resources. The approach should be legitimate and transparent, and ensure that the valuation method used for determining trade-offs is fair, as the management class has considerable economic, social and ecological implications.

WATER
Key to Wealth Building in Limpopo

Limpopo, historically one of the most impoverished provinces in South Africa, is one step closer to unlocking the doors to economic and social prosperity. Lani van Vuuren reports.

In May a Memorandum of Agreement (MoA) was signed between the Department of Water Affairs & Forestry (DWAF) and 23 mining companies involved in exploiting the mineral resources of the Eastern Bushveld complex regarding the R7,4-billion second phase of the Olifants River Water Resources Development Project (ORWRDP). The project involves the construction of the De Hoop Dam on the Steelpoort River to bring much needed bulk water supply infrastructure to the expanding mining sector and around 800 000 people on the Nebo Plateau in Sekhukhune district.

The MoA encapsulates the principles of agreement required for the conclusion of water supply agreements with the mines, and provides the necessary secured revenue flow to make the project bankable. The agreement specifically commits the mines to sign off-take agreements with DWAF for all future water requirements on a take-or-pay basis where the mines will pay for their respective costs based on allocated capacity, regardless of water use. The signature of the MoA enables the mines to start or continue their applications for mining licenses.

"This MoA will take us one step forward in our preparations to implement a bulk distribution system to convey raw water stored by the De Hoop Dam to places where the water could be treated and further distributed to small households and large industrial users," said Minister of Water Affairs & Forestry Lindiwe Hendricks at the signing ceremony. The project is being constructed through a mixture of private sector and State funding.

Lani van Vuuren

The signatories of the Memorandum of Understanding. A total of 23 mining companies signed the agreement with the Department of Water Affairs & Forestry.

Mining houses all over the world have been eyeing Limpopo's vast mineral resources. The province is home to some of the world's richest reserves of platinum, chrome, diamonds, coal and copper. However, new mining developments have been seriously hampered by the lack of water supply. By ensuring a secure supply of water, it will allow these mines and their support industries to proceed with a further estimated investment of R40-billion. This could see the establishment of as many as 90 000 jobs and generate an additional income of R2,3-billion a year in wages to this impoverished region of South Africa.

According to DWAF, the ORWRDP can be compared to the establishment of Rand Water in Johannesburg in 1903, which resulted in the construction of much needed bulk water supply infrastructure, such as the Vaal Barrage and the Vaal Dam. This allowed the Witwatersrand to build one the most powerful gold empires in the world.

The first phase of the ORWRDP, which involved the raising of Flag Boshielo Dam, near Marble Hall, by 5 m, has been completed. This project was completely funded by the mining sector in the province.

Construction on the realignment and construction of new roads around the De Hoop Dam started in 2007. TCTA has been appointed to oversee funding and implementation of the project. The dam will have a yield of 72 million m^3/a.

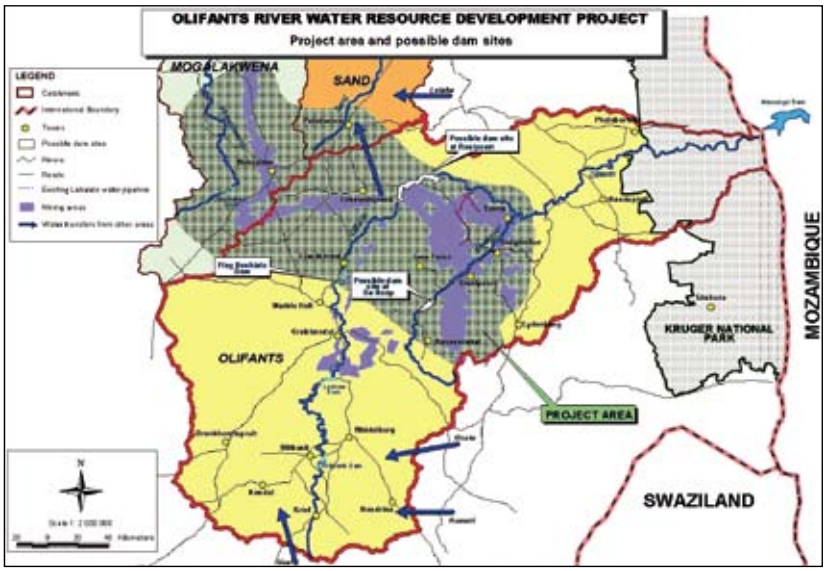
In addition to supplying water to the mines and surrounding communities, De Hoop Dam will also provide water for a new pumped storage scheme to be constructed by Eskom. The scheme, dubbed Project Lima, will provide an additional 1 500 MW to the national grid.

About 300 km of 700 mm- to 1000 mm-diameter pipelines bulk raw water pipelines will be constructed over a phased period as part of the project. However, water services authorities (mostly municipalities) will have to construct their own treatment works and distribution pipelines to convey water to their communities.

Hendricks issued a stern warning to the mining companies, saying that while her department realised the importance of the mines in generating economic wealth for the country, it would be keeping a close eye on their environmental compliance. "Private sector must realise that it has a responsibility, and the mining operations that will take place must be done in a responsible manner to sustain the livelihood for the generations still to come and to ensure that they do not pollute the water resources. It is a concern that water quality in some areas is being compromised as a direct result of mining. This is not acceptable and DWAF will be keeping a close eye to ensure there is compliance with the provisions of the law."

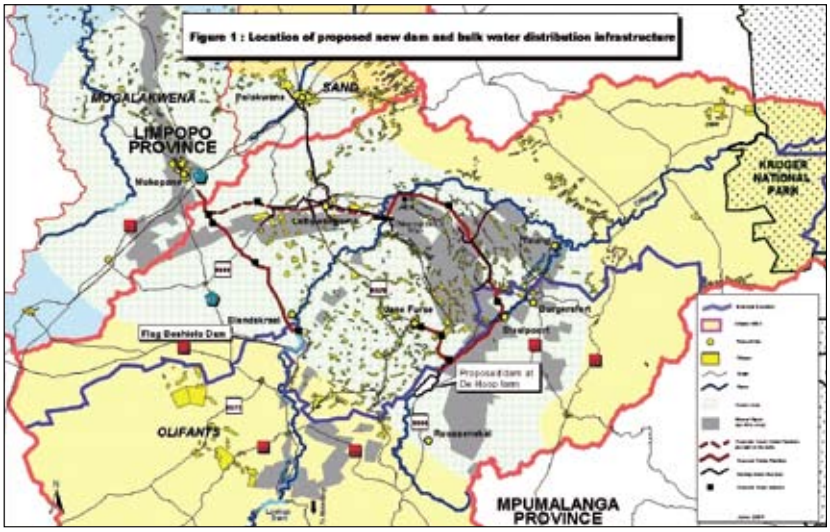
Commenting on the MoA, Dean Pelser of the Joint Water Forum said: "After many years of discussions with fellow mining houses, this long distant dream has become a reality." The Joint Water Forum represented the mining companies in discussions around the agreement. "Without the collaboration between the various mining houses, the critical mass required to support such a substantive project would not have been realised."

"We are now one step closer to unlocking Limpopo's economic wealth," said Pelser. "This would not have been possible without water."



Source: DWAF

Locality of De Hoop Dam.



Source: DWAF

The location of the Olifants River Water Resources Development Project.

Lani van Vuuren

Minister of Water Affairs & Forestry Lindiwe Hendricks and Dean Pelser of the Joint Water Forum (right) sign the Memorandum of Agreement.

Modern Technology Helps Farmers Save Water

An internationally acclaimed irrigation scheduling system, which has assisted small-scale sugarcane farmers in northern KwaZulu-Natal to improve their water use efficiency, is now being evaluated for wider implementation.

The *MyCanesim* system, which was developed through funds from the Water Research Commission and the South Africa Sugarcane Research Institute (SASRI), uses the potential of sophisticated information communication technology combined with participatory methods to assist sugarcane growers to save water while improving their crop yields. The system received the WatSave Award in the category 'Innovative Water Management' from the International Commission on Irrigation & Drainage last year.

Developer Dr Abraham Singels, a principal scientist at SASRI, explains that deciding how much and when to irrigate are important decisions that sugarcane growers have to make. "These decisions can have a direct effect on the profitability and sustainability of irrigated sugarcane production. Over-irrigation can lead to problems such as waterlogging, leaching of nutrients and excessive weed growth, while too little irrigation can cause severe yield losses."

He reports that several computer decision-support systems have been developed over the years to assist farmers with irrigation scheduling. The rapid progression of communications technology (including cellphones and the Internet) enables quick transfer of large volumes of data and information. "Unfortunately, these systems have mostly proven impractical and complex. As a result the uptake of these systems by the farming community in general has been very disappointing," notes Dr Singels.

This is specifically true for small-scale farmers who do not have access to expensive monitoring equipment, computers and the Internet to assist in irrigation scheduling. The challenge, therefore, has been to provide practical and useful advice to farmers using

state-of-the-art technology such as crop growth models and weather stations.

GOOD ADVICE IS ONLY AN SMS AWAY

To address this problem Dr Singels developed a centralised, automatic crop modelling system that provides simple, real-time and field-specific irrigation advice to sugarcane growers. "The system provides farmers with access to the power of modern technological advances without the hassle of having to learn how they operate," he explains.

The ***MyCanesim*** system comprises:

- A database of model inputs and outputs;
- A sugarcane simulation model (***Canesim***) that estimates the recent, current and future water balance, crop status and yield for a number of positions in a field;
- An irrigation scheduling and advice module that determines the ideal irrigation schedule based on the water balance of various positions in each field, and automatically generates and disseminates irrigation advice and yield estimates using mobile phone text messages; and
- An Internet-based user interface for advisors and extension staff to enter or edit field, crop and irrigation system data; and to view or download field reports. The interface has a friendly layout with an expandable menu tree.

Daily weather data are downloaded automatically from automatic weather stations, situated throughout the South African sugar industry. The SMS messages are sent to the farmers (in their mother tongue) whenever an action is required. The content comprises a suggestion to start, stop or continue irrigation for their field, with an estimate of current and final sugarcane yield. A confirmation SMS is sent at least once a week to reassure the farmer that the system is working.

In turn, advisors and extension officers receive a weekly summary (faxed or e-mailed), containing information for each field in a given scheme on the current irrigation action (irrigating or not), the expected date of the next action (stop or start), the expected date of the last irrigation, current cane yield and irrigation totals to date. In addition, reports containing detailed information, such as current and future cane yield, sucrose content and soil water deficit can be downloaded from the website.

SUCCESSFUL PILOT IMPLEMENTATION

The system was implemented on a pilot scale on two small-scale irrigation schemes at Pongola and Makhathini, in northern KwaZulu-Natal, using semi-permanent and portable overhead irrigation, with an average cycle between seven and ten days. The project started with seven farmers in 2004. After initial scepticism, growers closely and enthusiastically started following the advice. Today, there are 49 farmers actively using the system. Together, these farmers cultivate over 500 ha of sugarcane.

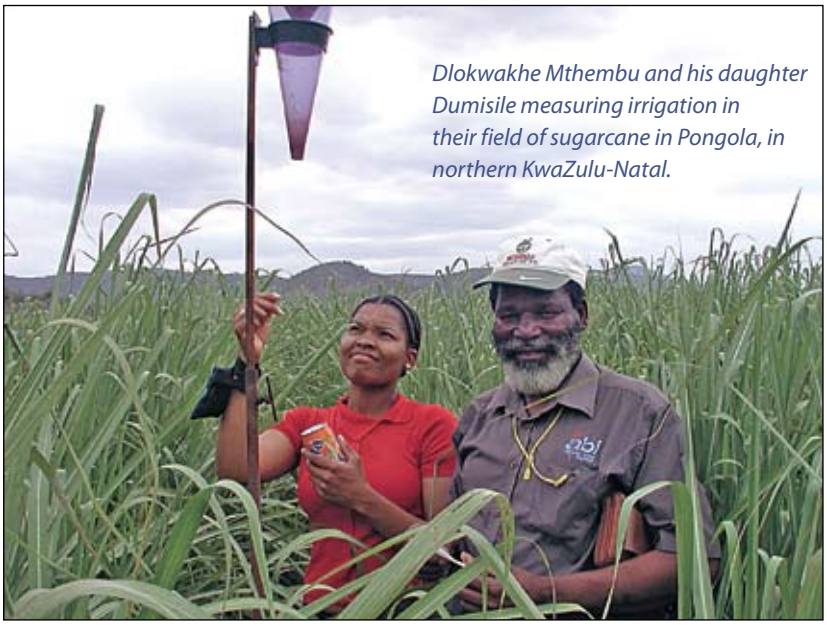
A participatory approach was adopted to ensure relevance and practicality. Farmers, extension staff and mill cane supply management contributed to the design of the Web interface, the advice and the reports generated by the system. Problems and progress were discussed at regular implementation and evaluation workshops.

These early pilot projects proved that the system worked well and that the advice from it had a significant impact on irrigation practices. For example, in Pongola, significant savings in irrigation water (in some cases up to 30%) were achieved. The main opportunity to save water proved to be during winter when the crop is small. These savings were made without cane yield being negatively affected.

IMPLEMENTATION CHALLENGES

Implementation of the system has not been without its challenges. First, irrigation advice is only relevant if farmers follow the advice, and that consequently there is a reasonable match between simulated and actual irrigation and water status. Dr Singels explains that there are various good reasons for farmers not to follow advice from time to time, for example, pump breakdowns, interruptions of water supply, and a need to wash in top dressed fertiliser.

To address this, the system has since been refined to accommodate a SMS reply from farmers when they cannot



Dlokwakhe Mthembu and his daughter Dumisile measuring irrigation in their field of sugarcane in Pongola, in northern KwaZulu-Natal.

or will not follow advice. The system interprets the reply in the context of the advice set and adjusts irrigation input data accordingly.

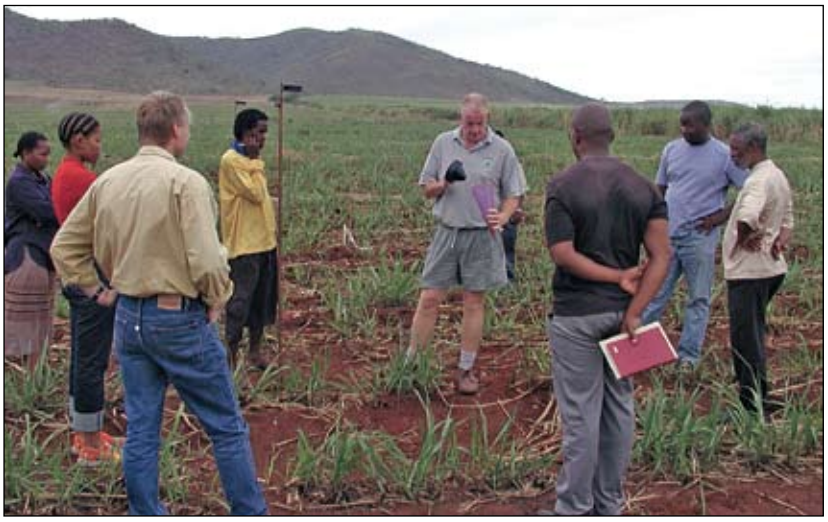
A challenge at the Pongola scheme was the fact that the majority of growers share pumps, and the associated costs with one or two neighbours. When all members of a pump group were not subscribed to the service, or did not receive similar advice, it often created conflict and non-adherence to advice. As a result, the system was adjusted to allow for synchronisation of advice for members of a pump group when the development stage of the different fields was similar.

The very low bandwidth Internet access (i.e. dial-up modem) made it difficult to use the system interface efficiently, while fax lines were not always operational. Internet access was not available at all in Makhathini. Interestingly, in neither Pongola nor Makhathini were cell phone coverage or ownership found to be limiting factors.

The five different options of irrigation advice

Advice	Context
Stop irrigation	The farmer was irrigating and the model indicates that he/she should stop.
Start irrigation	The farmer was not irrigating and should start irrigating.
Continue irrigation	The farmer was irrigating and should continue with the next cycle.
Do not irrigate	The farmer was not irrigating and should delay the start of the next cycle.
Terminate irrigation to dry off	No further irrigation required up to harvest.

The system also exposed other challenges faced by the small-scale sugarcane growers. For example, it was found at Makhathini that poorly maintained irrigation systems could only supply, on average, 50% of the crop demand and there was little opportunity for saving water. In fact, farmers should increase their applications to achieve economic yields.



Developer of MyCanesim, Dr Abraham Singels (centre with rain gauge), explains the technology to emerging sugarcane farmers.

Irrigation advice explained to a group of small-scale sugarcane growers.

IMPROVING ASSISTANCE

Through regular implementation and evaluation workshops, the project helped extension staff and farmers gain a much better understanding of the important factors that determined the crop water balance and how irrigation can be scheduled to impact positively on productivity and sustainability. The various reports available from the system provide concrete information (albeit simulated) for extension staff to benchmark irrigation practices, growth and yield of individual fields. This provided a good basis for discussion with farmers during field visits to identify agronomic practices that limited yields (such as poor crops stand, insufficient weed control, early cessation of irrigation, erratic movements of sprinklers and excessive sprinkler stand times), says Dr Singels.

A new pilot project was implemented with commercial growers. Although their situation and needs are different to that of small-scale farmers (for example, multiple fields per farm and drip and centre pivot irrigation systems), it has been proved that the system has the capability to deal with it. A project to implement the system for Mpumalanga sugarcane growers is also being explored.

"The initial success of the system shows that there is no reason why sophisticated technology cannot be used to assist farmers in managing sugarcane production," notes Dr Singels. "However, it is important that the complexity of the technology should be hidden from the users. The system shows great potential to be used as a tool to support extension staff to provide assistance to small- and large-scale farmers."

Berg River Dam: Designed With Rivers in Mind

TCTA

The Berg River Dam during construction.

The R1,5-billion Berg River Dam, outside Franschhoek in the Western Cape, is an international showcase of integrated planning, design and implementation, writes Nigel Rossouw, TCTA Head: Environment and Dana Grobler of Cape Action for People and the Environment.

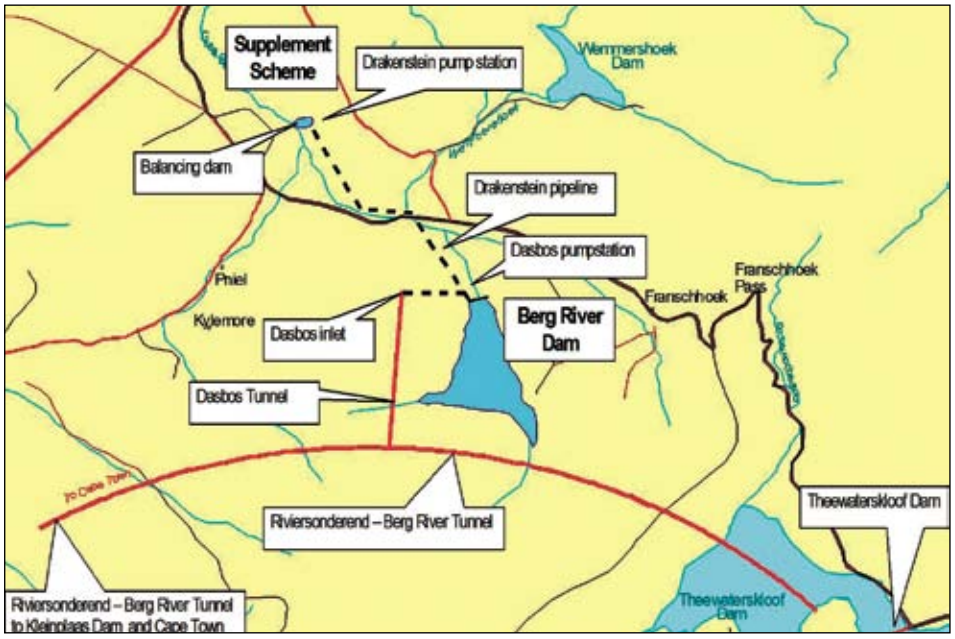
The Berg Water Project (BWP) is the culmination of a 14-year strategic integrated planning process by the Department of Water Affairs & Forestry (DWAF) to identify appropriate measures to address the water shortage in the Western Cape. The planning process was initiated in 1989. Back then it was called the Western Cape Systems Analysis (WCSA).

The purpose of the WCSA was to reconcile the water demand and water supply for the Western Cape region. The WCSA was a democratic public strategy process and was supported by technical and scientific assessment to aid decision making. The water situation assessment conducted as part of the WCSA determined that the City of Cape Town (CCT) would be the first metropolitan area in South Africa where water demand would exceed the available supply. The WCSA provided a list of project options that could be implemented to increase the water supply.

A KEY PROJECT

One of the key projects identified involved the construction of a dam on the upper reaches of the Berg River. DWAF initiated the environmental impact assessment (EIA) process and the EIA report as produced for decision making in 1996. The Department of Environmental Affairs & Tourism (DEAT) issued the Record of Decision in 1999. The Record of Decision stipulated that the dam should be designed so as to ensure flows for the Ecological Reserve. In addition, it also stipulated that if monitoring demonstrated that the dam had an undesirable effect on the river, then the release pattern and Ecological Reserve quantity would have to be revised.

In April 2002 Cabinet approved the construction of the BWP on condition that



The Berg Water Project comprises the Berg River Dam (which is about 6 km west of Franschhoek) and the Supplement Scheme situated about 12 km downstream. The latter comprises a 1,6 m-high diversion weir that diverts a portion of the winter high flows into a 3 ha off-channel balancing dam from where the water is pumped via a 12 km pipeline back into the Berg River Dam.

the CCT reduces the demand for water by 20% by the year 2020. The BWP is the first bulk water resource development project in South Africa that is directly linked to water demand management. In May 2002 the Minister of Water Affairs & Forestry directed the TCTA in terms of Section 103(2) of the National Water Act of 1998 to fund and implement the BWP as the implementing agent for DWAF.

"The Berg Water Project is the first bulk water resource development project in South Africa that is directly linked to water demand management."

The BWP would increase the yield of the Western Cape Water Supply System by 81 million m^3 or 18% from 2008. It was the first large water resource infrastructure development project in South Africa to be designed, constructed and operated within the framework of the National Water Act (Act 36 of 1998) and in accordance with the guidelines of the World Commission on Dams. The dam was therefore required to be able to make releases to satisfy all aspects of the Ecological Reserve as prescribed by the National Water Act.

The Berg River Dam is a concrete-face-rockfill dam type. The dam is 65 m high, 990 m wide and 220 m in width. The gross storage capacity of the dam is 130 million m^3.

The outlet works have been designed to release both low flows and high flows with provision for a peak release of up to 200 m^3/s, making it the first dam in South Africa in which provision is made for flood releases for environmental purposes.

WHAT IS THE ECOLOGICAL RESERVE?

In the National Water Act the Ecological Reserve is defined as: "relating to the water required to protect the aquatic ecosystems of the water resource. The Reserve refers to both the quantity and quality of the water in the resource, and will vary depending on the class of the resource."

In South Africa the terminology used for the provision of water of a suitable quality to protect the water resource is the Ecological Reserve. It is the only right in law. The term Instream Flow Requirement (IFR) is also commonly used in South Africa. This refers specifically to the flow requirement (both flow volumes and variability) to maintain a desired level of ecosystem functioning.

Internationally other terms such as environmental flow and ecological flow are also used. Globally accepted definitions are based on two aspects:

- The quality, quantity and timing of water flows required to maintain the components, functions, processes and resilience of aquatic ecosystems which provide goods and services to people, and
- The foundation from which socially-valued resources are derived and supported, and without which no sustainable use of the resource are possible.

A sustainable water resource and catchment management plan must be built upon a foundation of detailed scientific knowledge about the river flows (in terms of quantity and variability) and water quality needed to sustain ecosystem health and functioning. When the water needs of aquatic ecosystems (e.g. rivers, wetlands, estuaries, and groundwater) are clearly defined by scientists, engineers and other professionals, water managers will be able to find ways of meeting human needs for water while maintaining adequate river flows for the ecosystem to ensure long-term sustainable use of the Berg River.

In South Africa, aquatic ecosystem's water needs are determined during an Ecological Reserve Determination Study. This is an environmental water requirement prescription, which describes the necessary seasonal and inter-annual variation needed in low flows, high flows and floods, as well as the water quality requirement to support critically important ecological functions and for the continued provision of valued services.

The Ecological Reserve provides for the maintenance of critically important aquatic attributes, goods and services (such as biodiversity, dilution capacity, habitat integrity, prevention of sedimentation etc) and associated social services (including fishing and water for river-dependent users).

THE ECOLOGICAL RESERVE AND THE BERG RIVER CATCHMENT

The preliminary determination of the Ecological Reserve for the upper Berg River catchment for water quantity was set at 31,1% (i.e. 44,061 million m^3) of the mean annual runoff of 141,7 million m^3.

For the Ecological Reserve determination, detailed background studies and a comprehensive analysis were undertaken of the historical flows for the upper catchment. In the determination of the Ecological Reserve, the duration curves for the low flow releases to be made from the Berg River Dam were determined and the high flow releases required were established to be as follows:

- Daily average peak 65 m^3/s over three days = 10,11 million m^3 (160 m^3/s instantaneous peak)
- Daily average peak 30 m^3/s over three days = 4,67 million m^3
- Daily average peak 5 m^3/s over three days = 0,78 million m^3

What this means is that the Ecological Reserve releases will be based on providing a portion of the natural flow contributions (of inflows to the dam) of the upper Berg River catchment for ensuring the continued functioning of the aquatic ecosystem below the dam. According to the Determination, the ecological category of the Berg River was set at C (see Table 1).

DAM DESIGN AND THE ECOLOGICAL RESERVE

How has the Ecological Reserve influenced the design of the Berg River Dam? The requirement to implement the Ecological Reserve has dictated that the

TCTA

The south section of the intake tower is an open vertical shaft (wet well) with multi-level gates for drawing water from the dam for high flows/ floods (up to 200 m^3/s) as required by the Ecological Reserve.

The Berg River Dam from the air.

Berg River Dam be designed to cater for two distinct flow release systems, i.e. small releases and large releases.

The system for small releases occurs in the range from 0,3 m^3/s to 12 m^3/s. These releases occur continually and are adjusted in magnitude as required by the Ecological Reserve and depending on the inflow into the Berg River Dam.

The system for small releases is a conventional pipe system that extracts water from the dam for either environmental flows or for pumping to Cape Town to meet urban water demand. The system consists of pipes and valves in the intake tower, pipes under the embankment and the sleeve valves at the outlet works.

The Berg River Dam intake tower is divided into two sections. The north section is a dry shaft equipped with multi-level inlets, piped and valves, which provides the facility for drawing water into the Cape Town supply system and provides for low flow (under 12 m^3/s) environmental releases.

The radial arm gate system for large flows is able to make releases up to 200 m^3/s. These large flow releases will mimic naturally occurring flood events. The system for large flood releases is purely as a requirement of the Ecological Reserve and is unique. The system consists of a wet well in the intake tower, a concrete conduit through the dam wall and control gates.

The Berg River Dam intake tower is divided into two sections. The south section is an open vertical shaft (wet well) with multi-level gates for drawing water from the dam for high flows/floods (up to 200 m^3/s) as required by the Ecological Reserve.

DAM RELEASES AND THE ECOLOGICAL RESERVE

No base flow and high flow releases will occur out of phase with natural inflows into the Berg River Dam. Environmental flow releases to meet the requirements of the Reserve will comprise the summer and winter base flows of 4 m^3/s on average in June, July, August and September and the winter high flow releases of up to 160 m^3/s.

During the summer months inflows into the dam will be released to supply

the Ecological Reserve. Flood events of different magnitudes will be made each year to simulate the natural 65 m^3/s and a maximum instantaneous peak of 160 m^3/s. The outlet structure of the dam is designed to allow the instantaneous peak to be increased to 200 m^3/s. Dam releases will be operated in phase with the natural flood events.

High flow releases from the dam will be no greater than inflows into the dam, in other words, these would coincide with the magnitude of natural events. During periods of drought the magnitude of the Reserve releases would be reduced.

In drought years high flows will be released unless no natural flood inflow into the dam occurs at the appropriate time of the year. On average, about 16 million m^3 will be allocated for high flow releases each year and 27 million m^3 for low flow releases.

CONCLUSION

Compliance with the requirements of the Ecological Reserve is expected to achieve the following benefits:

- Maintain the Berg River in ecological category C;
- Maintain the river ecosystem to continue to provide users with acceptable water quality and an ecosystem that can support the living organisms in it;
- Prevent increased sedimentation in specific areas downstream of the dam (e.g. at Paarl); and
- Ensure that release patterns occur as close to the natural flow variability as possible (e.g. for inter- and intra-annual floods and wet and dry season low flows).

The Berg River Dam is internationally unique and is the first large in-stream dam in South Africa that is required to make both low and high flow (flood) Ecological Reserve releases. The dam will be operated to ensure that the releases of low flows and high flows coincide as closely as possible with natural inflows and natural flood events.

TABLE 1: River Ecological Categories

Categories	Description
A	Negligible modification from natural conditions. Negligible risk to sensitive species.
B	Slight modification from natural conditions. Slight risk to intolerable biota.
C	Moderate modification from natural conditions. Especially intolerant iota may be reduced in number and extent.
D	High degree of modification from natural conditions. Intolerant biota unlikely to be present.

TCTA

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TCTA

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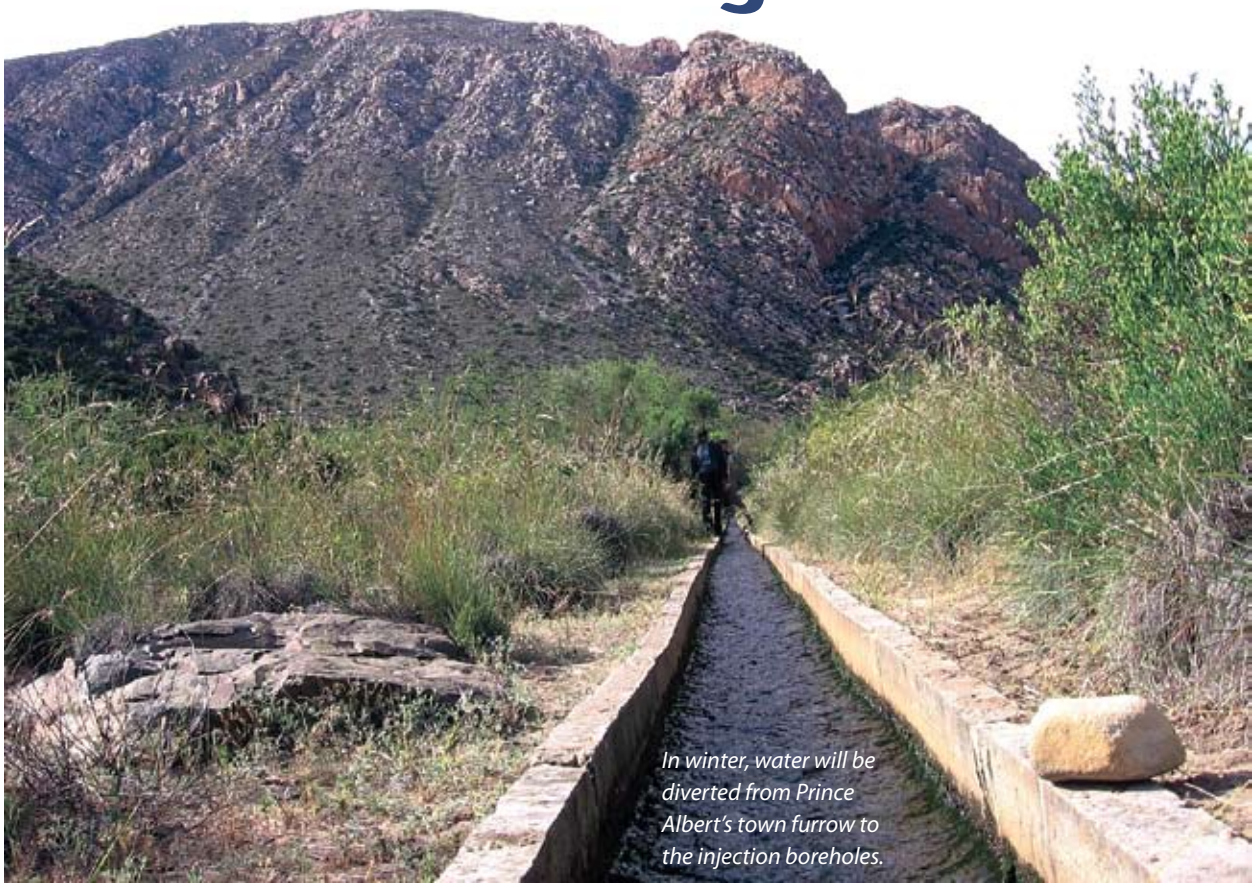
Artificial Recharge Gets Real



In winter, water will be diverted from Prince Albert's town furrow to the injection boreholes.

A new government strategy has given artificial recharge a welcome push as a conservation technique, writes Mike Wills.

Artificial recharge – transferring river or dam water underground into appropriate aquifers by means of infiltration basins or borehole injection – is finally gaining some impetus in South Africa as a water conservation and storage option for municipalities.

The Department of Water Affairs & Forestry (DWAF), with support from the Water Research Commission (WRC), has produced a detailed strategy on artificial recharge to encourage optimum usage of aquifers. This has already resulted in some action.

Borehole injection tests (where good quality surface water is injected into heavily used boreholes) are being planned for both the West Coast District as well as Prince Albert. In addition, Plettenberg Bay on the South Cape Coast, faced with a winter rainfall pattern and heavy summer holiday season demand, is also considering artificial recharge as a possible alternative to two other more expensive options, investing in an off-channel storage dam from the Keurbooms River or a desalination plant.

The West Coast District, which supplies Saldanha Bay and Langebaan, plans to inject about 4 000 m^3/day into the confined sandy aquifer that has shown a significant drop in borehole water levels over the past years. With artificial recharge, the municipality plans to restore the water levels and use the aquifer as a storage reservoir. This will increase both the water supply and its long-term security, especially in times of drought.

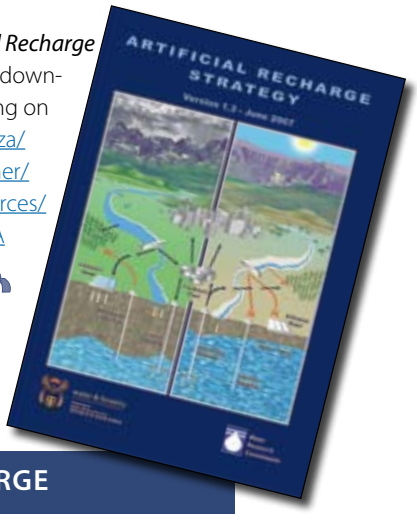
In turn, the municipality of Prince Albert plans to inject at a rate of about 20 ℓ/s into one of its groundwater compartments which has historically been over-pumped in summer months. If these tests prove that artificial recharge is a viable option for both municipalities, they will be the first examples of sizeable artificial recharge in the country using the borehole injection method.

Atlantis, near Cape Town, and the city of Polokwane have been implementing artificial recharge for decades, but they use infiltration techniques. Since most of South Africa is underlain by hard-rock formations, the borehole injection option is more appropriate for any extensive expansion of the technique.

The Prince Albert injection borehole test site.

Artificial recharge is a key weapon in conservation and storage in water-scarce regions, and DWAF believes its possibilities should be explored wherever it is technologically, economically, environmentally and socially feasible.

DWAF's Artificial Recharge Strategy can be downloaded by clicking on www.dwaf.gov.za/Documents/Other/Water%20Resources/ARStrategyForSAJun07.asp



Neighbouring Namibia has successfully implemented several artificial recharge schemes, including a large-scale injection project for Windhoek. DWAF is keen on South Africa following suit and, as part of its strategy, the department has now established a legislative framework, standard guidelines and a draft code of practice for the application of artificial recharge.

The new strategy document outlines all the environmental benefits of artificial recharge and details the global and southern African history of the technique. It also provides hydrogeological maps showing the areas with the greatest potential storage volumes. This includes the Limpopo, Crocodile West Marico, Lower Vaal and Lower Orange water management areas, although DWAF believes that smaller-scale opportunities exist in almost every region.

Clear criteria are also outlined for successful implementation, including high-quality surface water that is geochemically compatible with the existing groundwater and aquifer hydraulics which must allow for the recharged water to enter the aquifer rapidly and be contained within it.

There are several management and technical issues around artificial recharge, and good feasibility planning and testing are essential, with the correct siting of borehole injection points being an important factor. Clogging is identified as the key problem in most schemes around the world. Methods to prevent this from happening are detailed in the document along with the principles of 'safe yield' to ensure that groundwater levels are not raised or lowered beyond critical points.

TYPES OF ARTIFICIAL RECHARGE

Aquifer storage and recovery: Injection of water into a borehole for storage and recovery from the same borehole.
Aquifer storage transfer and recovery: Injection of water into a borehole for storage and recovery from a different borehole, generally to provide additional water treatment.
Bank filtration: Extraction of groundwater from a borehole, well or caisson near or under a river or lake to induce infiltration from the surface water body thereby improving and making more consistent the quality of water recovered.
Dune filtration: Infiltration of water from ponds constructed in dunes and extraction from boreholes, wells or ponds at lower elevation for water quality improvement and to balance supply and demand.
Infiltration ponds: Ponds constructed usually off-stream where surface water is diverted and allowed to infiltrate (generally through an unsaturated zone) to the underlying unconfined aquifer.
Percolation tanks: A term used in India to describe harvesting of water in storages built in ephemeral streams where water is detained and infiltrates through the base to enhance storage in unconfined aquifers and is extracted down-valley for town water supply or irrigation.
Rainwater harvesting: Roof runoff is diverted into a borehole, well or a caisson filled with sand or gravel and allowed to percolate to the water table where it is collected by pumping from a borehole or well.
Soil aquifer treatment: Treated sewage effluent, known as reclaimed water, is intermittently infiltrated through infiltration ponds to facilitate nutrient and pathogen removal in passage through the unsaturated zone for recovery by boreholes after residence in the aquifer.
Sand dams: Built in ephemeral streams in arid areas on low permeability lithology, these trap sediment when flow occurs, and following successive floods, the sand dam is raised to create an 'aquifer' which can be tapped by boreholes in dry seasons.
Underground dams: In ephemeral streams where basement highs constrict flows, a trench is constructed across the streambed keyed to the basement and backfilled with low permeability material to help retain flood flows in saturated alluvium for stock and domestic use.
Recharge releases: Dams on ephemeral streams are used to detain flood water. Uses may include slow release of water into the streambed downstream to match the capacity for infiltration into underlying aquifers, thereby significantly enhancing recharge.
Source: DWAF Artificial Recharge Strategy

WATER Kidz

Climate Change

This past June saw World Environment Day celebrations being held all across the world. This year's focus was on the effects of climate change – an issue affecting everybody on Earth.

WHAT'S THE BIG DEAL?

The climate of the world varies from one decade to another, and changing climate is natural and expected. Why are we worried about it now? Growing scientific evidence is suggesting that human industrial and development activities of the past two centuries are causing changes over and above natural variation.

Climate change is the natural cycle through which the Earth and its atmosphere are going to accommodate the change in the amount of energy received from the sun. The climate goes through warm and cold periods, taking hundreds of years to complete one cycle (think of the ice age, for example). Changes in temperature also influence the rainfall, but the biosphere is able to adapt to a changing climate if these changes take place over centuries.

Unfortunately, human activities are causing the climate to change too fast (using climate computer programs scientists predict the mean air temperature over South Africa could increase with an estimated 2°C over the next century).

WHAT CAUSES IT?

The global climate system is driven by energy from the sun, thus warming the Earth. Several gases in the atmosphere act to trap the energy from the sun, thus warming the Earth. These gases are called 'greenhouse gases' and the process is called the 'greenhouse effect'.

Without the greenhouse effect, the Earth would not be warm enough for human, plants, and animals to live. But if the greenhouse effect becomes stronger, extra warming may cause problems for humans, plants and animals. Human activities, such as the burning of fossil fuels (such as coal and oil), and deforestation (chopping up of natural forests) is increasing the amount of greenhouse gases (such as carbon dioxide) in the atmosphere.

Whenever we ride in or drive a car, we are adding greenhouse gases to the atmosphere. The trash we send to landfills produces a greenhouse gas called methane. Methane is also produced by the animals we raise for dairy and meat products. Also when factories make the things we buy and use everyday, they too are sending greenhouse gases into the air.

HOW MIGHT CLIMATE CHANGE INFLUENCE SOUTH AFRICA?

At this stage we don't know for certain what will happen (climatologists are not fortune tellers!) but science provides some clues. According to the South African Weather Service higher temperatures will influence the rainfall, but it is still uncertain how the annual rainfall will change. It could increase in some parts of the country and decrease in other parts. South Africa is already a water-scarce country, and a reduction in rainfall amount or variability, or an increase in evaporation (due to higher temperatures) would place further strain on our limited water resources.

Climate change may also the magnitude, timing and distribution of storms that produce flood events. Arid and semi-arid regions, which cover nearly half of South Africa, are particularly sensitive to changes in precipitation (i.e. rainfall), and desertification, which is already a problem in South Africa, could intensify.

In addition, there are several important insect-carried diseases which are sensitive to climate. A small increase in temperature would allow, for instance, malaria to spread into areas which are currently malaria-free, and would increase its severity where it already occurs.

HELPFUL WEBSITES

http://www.weathersa.co.za/References/Climchange.jsp
http://soer.deat.gov.za/themes.aspx?m=519
http://epa/gov/climatechange/kids/index.html
http://tiki.oneworld.net/global_warming/climate_home.html
http://globalwarmingkids.net
http://science.howstuffworks.com/global_warming.htm
www.coolkidsforacoolclimate.com
www.pewclimate.org/global-warming-basics/kidspage.cfm
www.deat.gov.za
www.dwaf.gov.za

www.sxc.hu

Growing world populations and a rise in industrialised cities are leading to a rise in greenhouse gases.

Historically, maize production has contributed to about two thirds of grain production in South Africa. If the climate becomes hotter and drier, maize production will decrease by about 10% to 20% over the next 50 years. An increase in pests and diseases would also have a detrimental effect on the agricultural sector, and invasive plants could become a greater problem.

If the warming of ocean water were to continue unabated, the polar icecaps will melt and the sea level will rise. This is anticipated in the next century. The consequences in South Africa of a small sea level rise are not very extensive because the coastline is relatively steep. However, changes in the oceans due to climate change could result in major changes in fish resources, which will affect South African communities dependent on fishing as a source of food and income.

CLIMATE CHANGE WORDS

Atmosphere: The mixture of gases surrounding the Earth. The Earth's atmosphere consists of about 79,1% nitrogen (by volume), 20,9% oxygen, 0,036% carbon dioxide and trace amounts of other gases. The atmosphere can be divided into a number of layers according to its mixing or chemical characteristics, generally determined by temperature.

Climate: Climate is the average of weather over time and space. A simple way of remembering the difference is that 'climate' is what you expect (for example, cold winters) and 'weather' is what you get (for example, a rain storm).

Climatologist: A person who studies climate.

Global warming: Global warming refers to an average increase in the Earth's temperature, which in turn causes changes in climate. A warmer Earth may lead to changes in rainfall patterns, a rise in sea level, and a wide range of impacts on plants, wildlife and humans.

Greenhouse effect: The effect produced as greenhouse gases allow incoming solar radiation to pass through the Earth's atmosphere, but prevent most of the outgoing infrared radiation from the surface and lower atmosphere from escaping into outer space. This process occurs naturally and has kept the Earth's temperature warmer than it would otherwise be. Present life on Earth could not be sustained without the natural greenhouse effect.

Greenhouse gas: Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include water vapour, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), halogenated fluorocarbons (HCFCs) , ozone (O_3), perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs).

Weather: Weather is the specific condition of the atmosphere at a particular place and time. It is measured in terms of such things as wind, temperature, humidity, atmospheric pressure, cloudiness, and precipitation. In most places, weather can change from hour-to-hour, day-to-day, and season-to-season.

Source: EPA

Plants, in particular, have trouble keeping up with rapid climate change. Small, isolated populations could go extinct as a result. South Africa is home to about 10% of all the plant species in the world, of which about half occur nowhere else on Earth. Warming, and a change in the seasonal rainfall of the Cape floral kingdom, which is unique to South Africa, are issues of particular concern to conservationists.

WHEN DO YOU SEND GREENHOUSE GASES INTO THE AIR?

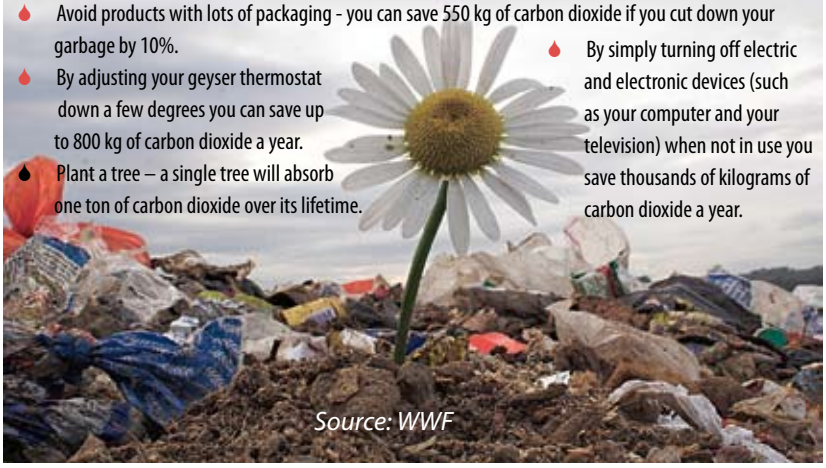
Whenever you:

- Watch TV
- Use the air-conditioner
- Play a video game
- Listen to a stereo
- Turn on a light
- Use a hairdryer
- Wash or dry clothes
- Use a dishwasher
- Microwave a meal

Why? To perform any of these functions, you need electricity. Electricity comes from power plants, which use coal and oil to make electricity. Burning coal and oil produces greenhouse gases.

WHAT CAN YOU DO TO SLOW DOWN CLIMATE CHANGE?

- Replace regular light bulbs with compact fluorescent light bulbs.
- Walk, bike, carpool or take public transport – you will save 0,5 kg of carbon dioxide for every kilometre you don't drive.
- Recycle more – you can save 1 100 kg of carbon dioxide a year by recycling just half of your household waste.
- Avoid products with lots of packaging - you can save 550 kg of carbon dioxide if you cut down your garbage by 10%.
- By adjusting your geyser thermostat down a few degrees you can save up to 800 kg of carbon dioxide a year.
- Plant a tree – a single tree will absorb one ton of carbon dioxide over its lifetime.
- By simply turning off electric and electronic devices (such as your computer and your television) when not in use you save thousands of kilograms of carbon dioxide a year.



Source: WWF

Water Conference Attracts Record Number

The biennial conference of the Water Institute of Southern Africa (WISA), held at Sun City in May, attracted a record number of delegates this year. More than 1 200 participants, including water sector professionals, decision makers, local government officials and researchers attended the conference which centred around the theme 'The Confluence of the Water Industry'.

Above: *WRC CEO Dr Rivka Kfir delivered the keynote address on the importance of gaining knowledge in the fight to overcome the challenges of the South African water sector.*

Right: *Well-known journalist and TV personality Denis Beckett motivated the audience with his positive outlook on the future of South Africa.*

Left: *Dr Anthony Turton of the CSIR participated in a debate on whether South Africa was experiencing a water crisis.*

Above: *A total of 64 exhibitors advertised their products and services at the conference.*

Above: *The WRC stand, which featured latest reports and other knowledge dissemination information, attracted numerous visitors.*

South African
National Committee
on Large Dams

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Three and a Half Day Course on

Dam Monitoring and Surveillance

Monday 15 to Thursday 18 September 2008
Venue: Protea Hotel, Technopark, Stellenbosch, SOUTH AFRICA

ECSA Continuing Professional Development (CPD) accredited course

SANCOLD (South African National Committee on Large Dams) and the Department of Civil Engineering, University of Stellenbosch invite you to join them for a ***Course on Dam Monitoring and Surveillance*** at the Protea Hotel, Technopark, Stellenbosch, Monday to Thursday 15-18 September 2008 (3.5 days). They have an interesting programme lined up for you. The two-day technical programme (15-16 Sep) is filled with presentations on applications of instrumentation to measure field performance, recent research into new instrument types and new applications, what we can expect from technological advances in the near future, and quantifying the benefits of monitoring systems. They have invited several speakers who are spearheading new developments in monitoring technology to demonstrate what is possible with today's tools.

On Wednesday 17 September 2008 a technical ***Dam Safety Surveillance tour*** to the recently completed Berg Water and Roode-Elsberg dams are included in the programme. A half day ***Workshop*** is offered on Thursday 18 September 2008 by leading authorities on various topics related to the practical aspects of instrumentation. The tour and workshop will help you put what you've learned to productive use.

The course will focus on the following themes and topics:

Theme 1 – Case Studies:
The role of field measurements in problem-solving, research, safety assessment, risk assessment and improving the design of dam engineering structures and appurtenant works.

Theme 2 – State-of-the Art and Future Trends:
The latest in measurement technology, equipment, communication methods, data management and interpretation, and visions for future development.

Theme 3 –The "Practical Side" of Instrumentation:
Demonstrating and quantifying the benefits of field measurements to project management teams, owners, engineers, contractors, regulators and insurers.

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