THE WATER WHEEL

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WRC Revives Fight Against EUTROPHICATION

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IMPLEMENTING ENVIRONMENTAL WATER ALLOCATIONS

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DEPARTMENT OF WATER AFFAIRS & FORESTRY (DWAF), SouthAfrica

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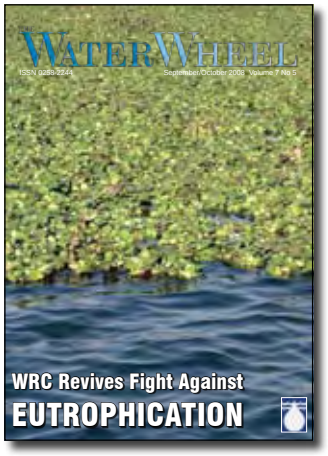

***Cover**: Renewed investment in eutrophication research is refocusing attention on one of South Africa's most prolific water quality problems. (See page 14).*

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LETTERS TO THE EDITOR

Incorrect water treatment chemistry also causes problems

Your article "Cheap Plumbing Imports Wastes Precious Resources" (*Water Wheel* July/August 2008) refers.

The problem of inferior plumbing is mostly exacerbated by the incorrect water treatment chemistry. Poor pH control at the treatment works, especially of corrosive coastal type waters also causes a major loss of water for the following reasons: Low pH of water (due to the lack of lime addition) will cause ineffective coagulation and flocculation at the works, thus overloading sand filters, which requires more frequent back washing and consequent water losses. This also causes post flocculation in reservoirs, leading to poor water quality.

The low pH water will corrode the reticulation system, causing pipe failures and leaks.

Refer to the corrosion on the photo of the standpipe in the article (top left hand on p. 18).

Johan Barnard, Civil Engineering Department, Nelson Mandela Metropolitan University

Inferior plumbing products – institutions need to act

I refer to your informative and accurate report, *Cheap Plumbing Imports Wastes Precious Resource* (July/August 2008 issue of *the Water Wheel*) on the wastage of water by inferior plumbing products. As someone who worked 27 years for a municipality and served on the JASWIC Committee for 10 years, I witnessed water wastage due to inferior plumbing products.

My main concern has been the lack of action by institutions such as DWAF and the SABS, of both the previous and present governments. These institutions hide behind "we can't stop anyone selling a product over the counter".

DWAF is strongly promoting water conservation and demand management in municipalities, but nothing is being done about the inferior workmanship and cheap toilet systems being installed in state-subsidised housing projects.

Toilets leak almost from the day owners move in and Municipal Water and Drainage Inspectors are almost non-existent. Some municipalities have had to initiate retrofit projects in houses to correct poor installations. DWAF actually supplied Chinese products, of dubious quality, to municipalities.

We need to follow the example of other countries such as Australia, who are leaders in this field.

David Raymer, Uhambiso Consult, Port Elizabeth

Kilo vs Mega

The letter "Water figures incorrect" in the July/August 2008 edition of *The Water Wheel* refers.

Numbers will explain the dispute the best: Kilo = 10^3; Mega = 10^6. There is 1 000 litres in 1 cubic metre. Therefore, 1 kilolitre = 1 cubic metre.

A megalitre (Mℓ) will therefore be equal to 1 000 000 litres is equal to 1 000 kilolitres is also equal to 1 000 m^3.

So, to use the exact same values as N Govender: 325 Mℓ per year is in fact equal to 325 thousand m^3 per year. 50 Mℓ per year is equal to 50 thousand m^3 per year. 3 Mℓ per year is equal to 3 thousand m^3 per year. Maybe this will help reduce our electricity bills.

Harold Smook, BKS

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.

New degree to up water resources management skills

The University of Pretoria Water Institute (UPWI) and the Georgia Water Resources Institute (GWRI) in the US have joined forces to launch a new MSc qualification in water resource management.

Since its official inauguration in March last year, the UPWI has seen unprecedented success in achieving its aim of providing a research and education platform for meeting the water challenges facing South Africa and the African continent in a sustainable manner, reports Head of the Department of Microbiology and Plant Pathology Prof Eugene Cloete. Prof Cloete also heads up the Southern Education and Research Alliance Task Team.

"Currently the world is experiencing a water crisis. This is largely a matter of governance issues, including sector fragmentation, poverty, inadequate finances, declining levels of development assistance and investment in the water sector, inadequate institutions, human capacity limitations, limited stakeholder participation and, most notably, the lack of information sharing," notes Prof Cloete. The collection, dissemination and exchange of water-related information and know-how is therefore a matter of priority to improve the sharing of knowledge and building human capacity concerning water-related issues, he says.

GWRI Director Prof Aris Georgakakos adds that sustainable water resources development and management are key to economic development and societal change in Africa. "This is because water resources are the basis of agricultural activities which, in Africa, employ more than 80% of the labour force and generate more than 50% of the gross domestic product. Moreover, water resources support hydropower development which powers industrial growth."

Comprehensive appreciation of all water-related issues and disciplines is of vital significance for effecting environmental and socio-economic change, the two institute leaders maintain. The joint MSc degree was conceptualised with these in mind. This educational and applied research programme, called Aware, combined the expertise and strengths of the two water institutes. It is aimed at creating qualified human resources that will serve ably African governments, industries and academia.

International nano conference coming to SA

An international conference on nanotechnology will be held in Pretoria on 1 to 4 February, 2009.

NanoAfrica 2009 is organised jointly by the South African Nanotechnology Initiative and the CSIR National Centre for Nanostructured Materials in association with the Department of Science & Technology. This is the third international nanotechnology conference to be held in the country. The other conferences were hosted by Cape Town in 2004 and 2006.

According to the CSIR, the conference will provide a forum for local and international students, researchers, technologists and entrepreneurs to interact on the latest developments and future trends in the multidisciplinary area of nanoscience and nanotechnology. Plenary and keynote lectures by leading international scientists, invited talks, contributed oral and poster presentations will offer delegates a good opportunity to learn about the latest research developments in this diverse field.

Key areas of focus will include novel nanomaterials synthesis; advanced nanostructured materials; nanotechnology and health/water/energy/textiles; and nanomaterials characterisation and metrology.

For more information, visit www.nanoafrica.co.za

Gauteng budgets R3bn to eradicate informal settlements

More than 380 000 families will benefit from the Gauteng Department of Housing's informal settlement formalisation programme in this financial year, according to MEC for Housing Nomvula Mokonyane.

She made the announcement during the presentation of her budget speech for the 2008/09 financial year at the Gauteng Legislature in June. The province is confident that it will eradicate all remaining 56 registered informal settlements by the 2014 target date. The provincial housing budget of R3-billion shows a 17% increase from the previous year.

"In achieving this milestone, we will continue to execute our strategy through our five key programmes, namely mixed-housing development, eradication of informal settlements, alternative tenure, the Urban Renewal Programme, and the 20 Prioritised Townships Programme," said Mokonyane.

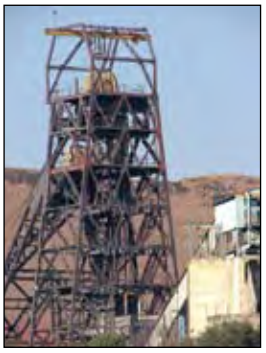
The department identified 122 informal settlements in 2004 to be upgraded by 2009. To date, 68 informal settlements have been formalised (i.e. upgraded in situ), resulting in 325 000 people having access to water and sanitation. "It is our goal to provide necessary services and tenure to about 710 000 people by 2009," noted Mokonyane.

WATER ON THE WEB

www.knowh20.org
This website is a water education initiative from the non-governmental organisation (NGO) Playpumps International. The website promotes the NGO's work in schools by providing background information on the world water crisis and lesson plans for teachers, which they have developed with the National Youth Leadership Council.

www.watereum.org
The Effective Utility Management Resource Toolbox provides links to key resources and measures designed to help water and wastewater utilities further improve the management of its infrastructure.

Calling all mine water researchers



Abstracts have been invited for the International Mine Water Conference to be held in Pretoria from 19 to 23 October next year. Organised by the Water Institute of Southern Africa's Mine Water Division, together with the International Mine Water Association, the conference will centre around a series of themes. These include environmental best practice guidelines, mine closure, mine water treatment, management of brines and sludges, integrated water resources management, geochemistry and impact prediction, and management and rehabilitation of mine residues, among others.

The conference organisers will offer a special student award in recognition of the importance of continuing to attract young scientists and engineers into the field of mine water management. A cash prize of R15 000 is up for grabs for the best technical paper written and presented by a bona fide student. Students from around the world are invited to participate.

Abstracts of between 200 and 500 words can be submitted electronically to minewater2009@wisa.org.za. The deadline for abstracts is 15 January 2009.

Insects making huge impact

Entomology has made a significant contribution to saving water and reducing the burden of disease in South Africa, according to Minister of Science & Technology Mosibudi Mangena.

Speaking at the 23d International Congress of Entomology held in Durban in July, he said two areas in which South Africa's entomologists have made a huge impact are in the use of insects as biological control agents against invasive alien plants, and the combating of malaria. "An estimated 8 000 alien plant species have been introduced to South Africa. As a result, water flow from some catchment areas has been reduced by as much as 22%."

Mangena noted that the use of insects have been used effectively as bio-control agents against invasive alien plants. "We are encouraged that none of the agents introduced into South Africa have resulted in substantial damage to crops or indigenous species."

In addition, entomologists were working towards reducing the impacts of malaria through the South African Malaria Initiative, a national consortium of researchers who are pooling their expertise to find ways of dealing with the disease.

WATER DIARY

WATER SCARCITY
NOVEMBER 1-7
An International Conference on Wetland Systems Technology for Water Pollution Control will take place in Indore, India. *Visit: www.wetland2008.org/SaveWater/*

WATER SERVICES
NOVEMBER 4-6
The Multiple Use Services Group and the RiPPLE (Research-inspired Policy and Practice Learning in Ethiopia and the Nile Region) research consortium are organising an International Symposium on Multiple Use Water Services. *E-mail: symposium@musgroup.net*

CLIMATE CHANGE
NOVEMBER 13-14
An international conference on the Role of Information in an Age of Climate Change will be held in Aarhus, Denmark. *Enquiries: Jakob Bek-Thomsen; Tel: +45 8942 1966; E-mail: jbt@adm.au.dk*

IRRIGATION
NOVEMBER 18-20
The SANCID Symposium will take place at Club Mykonos in Langebaan, in the Western Cape. This year's theme is 'Agricultural Water Management for Sustainable Livelihoods'. *Enquiries: Riana Lombard (Event organiser); Tel/Fax: (021) 855-5412; E-mail: riana@sabi.co.za; Web: www.sancid@org.za*

WATER SCARCITY
DECEMBER 1-5
An International Conference on Water Scarcity, Global Changes and Groundwater Management Responses will be held in Irvine, the US. The conference is convened by UNESCO, the University of California and USGS. *Enquiries: Contact Diana Dehm or Megan Kinzer, University of California, Irvine, E-mail: UNESCOUC@uci.edu*

ECOLOGY
DECEMBER 2-5
The Sixth International Conference on Ecological Informatics will take place in Cancun, Mexico. *Visit: http://isei6.unipamplona.edu.co/*

ENVIRONMENT
DECEMBER 15-17
The School of Chemical Engineering at the University Sains Malaysia is hosting the International Conference on Environment (ICENV 2008). *Enquiries: icenv2008@eng.usm.my*

Research on small water flea helps teenager win big prize

Research on small planktonic crustaceans, known as Daphnia, or water fleas, has earned Western Cape teenager Raksha Gosai (15) the 2008 South African Youth Water Prize (SAYWP).

Once thought of as creatures of polluted waters, Daphnia have been proven to be very sensitive to poor water conditions, and they are often used to monitor water quality. They replicate rapidly and any difference in the physical state of the clones is due to environmental factors, such as an increase in pollution levels.

Gosai, a Grade 11 pupil from Vredendal High School went on to compete against youth from 30 participating countries for the Stockholm Youth Water Prize in Sweden.

The SAYWP is an initiative of the Department of Water Affairs & Forestry. The aim of the Award is to enhance the interest of high school learners in science and technology towards a possible career in the water sector. Participants identify problems related to water and sanitation in their communities, conduct research and develop innovative solutions and/or inventions to solve the problem.

Runners-up to the South African competition were Truth Mkhize and Welcome Khuzwayo of Ukusa Secondary School in KwaZulu-Natal with third place going to Bakang Gaobuse, Kealeboga Mohibidu and Lebogang Josephs of Baitiredi Technical & Commercial High School in the Northern Cape.

SA Youth Water Prize 2008 winner Rakshai Gosai

Framework Unites SA Under Sustainable Development Vision

For the first time South Africa has a single coherent framework that articulates the country's development context, sets out its common vision and strategic areas of intervention for achieving sustainable development.

The National Framework for Sustainable Development was approved by Cabinet earlier this year. According to Department of Environmental Affairs & Tourism DG Nosipho Jezile-Ngcaba, the launch of the national framework completes the first phase of a three-phase process to ensure the sustainable development of the country and its people. Phase II, which is currently underway, involves preparing and planning for action, and includes the development of a detailed action plan and the mobilisation of the necessary resources. In turn, phase III will entail the process of roll-out, implementation, monitoring and review.

This is part of a commitment South Africa made along with other countries at the World Congress on Sustainabe Development in Johannesburg in 2002 to prepare and implement national strategies for sustainable development. "A sustainable development paradigm is integral to our 2014 vision, as it defines the social, economic, environmental and governance parameters, and explicitly recognises the constraints that decision-makers must take into account when policies are adopted aimed at growing the economy, sustaining our natural resource base and meeting basic social and human needs," said Jezile-Ngcaba.

Rather than being a sustainable development 'master plan' the framework seeks to build on existing programmes and strategies that have emerged in the first 14 years of democracy. It aims to identify key, short-, medium- and long-term challenges in South Africa's sustainable development efforts, sets the framework for a common understanding and vision of sustainable development, and defines strategic focus areas for intervention.

The national framework is divided into four main parts. Part One sets the context for South Africa's sustainable development paradigm and outlines the rationale for the approach that was taken in developing the framework. Part Two identifies focus areas for strategic intervention that are necessary to achieve the national vision of sustainable development.

In turn, Part Three elucidates the critical pathways that are needed to achieve the desired state of sustainable development and to contribute to shared and accelerated growth. Five strategic focus area are described for intervention: enhancing systems for integrated planning and implementation; sustaining our ecosystems and using natural resources efficiently; economic development via investing in sustainable infrastructure; creating sustainable human settlements and responding appropriately to emerging human development, economic and environmental challenges. The last part, Part Four, describes the three-phased road map that needs to be embarked upon to reach the national vision.

The framework document points out that South Africa's shared growth and poverty eradication strategies are not as effective as they could be in decoupling from unsustainable natural resource use and exploitation. Analysis of natural, social and economic governance confirms that thresholds are now being reached which, if ignored, will generate dysfunctional economic costs that will undermine investments in economic development and exacerbate poverty as poor people experience the loss of supportive ecosystem services.

It is expected that the framework will be used by all social partners and all organs of state within the national, provincial and municipal spheres to progressively refine and realign their policies and decision-making systems in order to establish a coherent and mutually consistent national system aimed at promoting sustainable development.

To access the National Framework for Sustainable Development, go to www.environment.gov.za

Another water treatment contract for VWS Envig

Specialised water treatment company VWS Envig has been awarded a contract to supply a 2 400 km³/day desalination plant to Transnet.

The turnkey project involves the design, manufacture, installation and commissioning of a reverse osmosis (RO) desalination plant for use at Transnet's iron-ore terminal at the Port of Saldanha. The harbour is South Africa's only iron-ore handling port, and this contract forms part of a larger upgrade and expansion project.

A water treatment plant employing the patented Actiflo clarification process.

Project manager Thys Els says the plant will be able to be upgraded to a capacity of 3 600 m³/day if necessary. The project will be executed in two phases, namely a design phase and supply phase, with the latter depending on approval of the Record of Decision.

"The plant will process seawater to potable standards to be used for dust suppression in the iron-ore terminal. The company is using municipal water for this purpose at present," explains Els.

The new plant will comprise a seawater intake, RO units, a clean-in-place system, energy recovery system and a storage tank. "The energy recovery system is a key element of the plant's design. In the desalination process, a higher pressure, and thus more power, is needed to reject the salt. Based on specialised technology that has only become available in recent years, the recovery system directs unused energy from the RO process to the beginning of the process, thus saving on power consumption" notes Els.

In other news, the company is to provide a complete water treatment plant to an African gold mine to remove arsenic and other contaminants from mine-water.

According to Francois Gouws, Director: Design and Build Projects, the company will be drawing on the success and expertise of its Australian sister company. The 7 000 m³/day plant will use a number of processes to remove salt, dissolved iron, heavy metals, manganese, and other contaminants from the water.

It is expected that the plant will make use of the patented Actiflo clarification process. Other treatment steps will include filtration, potassium permanganate dosing and reverse osmosis. Treated water from the process will be used for irrigation purposes.

Cash injection for KZN water infrastructure

The country's second-largest water board, Umgeni Water, will spend R1,8-billion over the next five years on infrastructure projects through its Capital Works Programme.

This is as a response to economic growth and to meet the national water targets, the company said in its latest *Annual Report*. During the past year Umgeni Water continued with the planning, design and implementation of water supply infrastructure projects that focused on the augmentation of the water board's existing bulk infrastructure as well as the extension of bulk supply networks into previously unserviced areas. Major projects included the upgrade of at least seven large pipelines as well as the construction of two booster pump stations.

Umgeni Water's most significant construction project during the past year was the construction of a new pipeline along the South Coast from Amanzimtoti to Park Rynie to supply areas within eThekwini Metro and Ugu District Municipality. The pipeline is capable of delivering an average annual daily demand of 65 Mℓ/day. The project comprises 40 km of pipeline, three service reservoirs and two booster pump stations.

WATER ON THE WEB (CONTINUED)

www.remunicipalisation.org
This website was set up as an initiative of the activist-scholar network Transnational Institute and social justice lobby group Corporate Europe Observatory. The websites cites a number of high-profile private water company failures, where water services have been taken back into public management. It also provides case studies of cities that have successfully taken back control of water services from private companies and information of present campaigns tackling privatisation issues.

www.toxipedia.org
Toxipedia is a free toxicological encyclopedia written by experts and edited for accuracy. It is also a resource centre that provides a place for people to discuss numerous topics, and find educational materials. Water-related topics include endocrine disruptors, environmental justice, environmental laws, nanotechnology, pesticides, and persistent environmental contaminants.

New from the WRC

Report No: TT 267/08

Technology Transfer and Integrated Implementation of Water Management Models in Commercial Farming (A Pott; N Benadé; PS van Heerden; B Grové; JG Annandale and M Steyn)

Commercial irrigation accounts for about 62% of South Africa's total water use. There have been increased calls for the irrigation sector to improve its water use efficiency, and through the years the WRC has funded various research projects to achieve just that. These projects have resulted in the development of several irrigation efficiency models and programs, including the Agricultural Catchment Research Unit (ACRU) model, Water Administration System (WAS), irrigation scheduling program (SAPWAT), Soil Water Balance (SWB) and Risk Management Simulation Model (RISKMAN), which have all have proved to be popular and are used widely. A new technology transfer project involved water user associations and water boards to act as centres of excellence as a means of lesson sharing. A central feature of this project is to capture accurate data in a geographic information system (GIS). The project will assist in providing water resource managers and other stakeholders with valuable information, enabling them to evaluate water management scenarios.

Report No: 1286/1/07

Development and Application of Prokaryotic Biosensor Systems for the Evaluation of Toxicity of Environmental Water Samples (B Pillay and D Pillay)

Pollution of water systems poses a severe threat to human health and is of serious environmental concern. The problem is exacerbated by the fact that detection of pollutants in the environment is currently time-consuming and expensive. The WRC funded a successful study into the evaluation of eco-toxicity testing using bacterial bioluminescence biosensors as an effective and cost-efficient means of detecting pollutants in water. Detection is based on the production of light in modified bacteria, through the effect bio-available pollutants have on the metabolic activity of cells. The amount of light emitted provides an indication of the presence of toxic substances, and a measure of the toxicity of the pollutants. Several different bacterial biosensors with the ability to emit a readily detectable signal (light) in the presence of a wide range of environmental pollutants were developed. The data generated from the research proved the potential of using biosensors to monitor pollution in water resources.

Report No: 1502/1/08

PCB-based Markers for Detection and Identification of Toxic Cyanobacteria (Anna-Marie Botha-Oberholster and Paul Johan Oberholster)

Toxic cyanobacteria found in eutrophic, municipal and residential water supplies are an increasing environmental hazard in South Africa. The objectives of this study were to determine the genetic diversity and population structures in selected South African water reservoirs; and to determine the potential of using the *mcyB* sequence as a diagnostic tool in raw water to detect the presence of toxin-producing cyanobacterial spp. in South African water reservoirs.

Report No: 1320/1/08

Definition and Upscaling of Key Hydrological Processes for Application in Models (Simon Lorentz; Kevin Bursey; Olufemi Idowu; Cobus Pretorius and Kalala Ngeleka)

The clear definition and quantification of the sources and pathways of components of discharge making up streamflow is becoming increasingly important. This project aimed to define key hydrological processes at a range of scales by observation and experimentation at these scales in order to improve deterministic, physically-based simulation tools so that land-use changes, streamflow reduction activities, surface and groundwater interactions and topological runoff generating mechanisms are linked conceptually and spatially to the responses at each scale.

Report No: 1250/1/08

Market Risk, Water Management and the Multiplier Effects of Irrigation Agriculture with Reference to the Northern Cape (DB Louw; HD van Schalkwyk; B Grové and PR Taljaard)

The main objective of this project was to quantify the impact of market risk on the efficient use of irrigation water and to determine the multiplier effects of irrigation accompanied by a shift in production patterns, with reference to the middle and lower Orange River, on the total economy of the Northern Cape. The project also looked at identifying and quantifying risk factors in irrigation agriculture; developing a decision-making framework that farmers can use to reduce their risk; comparing present water-use practices with optimal risk-reducing practices; and developing a policy framework for irrigation agriculture that would reduce risk and improve the financial viability of the individual farmers and of irrigation schemes.

Report No: TT 348/08

On-Site Mobile Training of Operators in Small Rural Water Supplies: An illustrative kit (MNB Momba; N Makala and M Dungeni)

A major barrier to the production of safe drinking water in many areas of South Africa is the inadequate qualifications and training of many operators and supervisors at small treatment plants. This is particularly a problem in newly established municipalities which did not previously have water services.

In rural water treatment plants there is a need for more operators to upgrade their training in order to achieve the necessary improvements in performance to produce water that is consistently safe to drink. This illustrative kit follows on the on-site mobile training of 26 operators from seven different small water treatment plans in the Eastern Cape. It emphasises why each step in water treatment is important and how to check the performance at each stage.

Report No: 1507/1/08
Determination of the Impact of Coal Mine Water Irrigation on Groundwater Resources (PD Vermeulen; BH Usher; and GJ van Tonder)
It is predicted that vast volumes of impacted mine-water will be produced by mining activities in the Mpumalanga coalfields of South Africa. Research over more than a decade has shown that this water can be used successfully for the irrigation of a range of crops. There is, however, continuing concern from local regulators regarding the long-term impact that large-scale mine-water irrigation may have on groundwater quality and quantity. The results from this study into the potential impact of coal mine-water irrigation on groundwater resources indicate that many of the soils have considerable attenuation capacity and that in the period of irrigation, a large proportion of the salts have been contained in the upper portions of the unsaturated zones below each irrigation pivot. The volumes and quality of water leaching through to the aquifers have been quantified at each site. From this, mixing ratios have been calculated to determine the effect of the irrigation water on the underlying aquifers and expected salt load addition from different irrigation options.

Report No: 1411/1/08 & 1411/2/08
The Development of a Hydraulic Model for Determining Bed Disturbance Due to Floods in Cobble and Boulder Bed Rivers (J Cullis; M Gazendam; A Rooseboom; and G Ractliffe) & Flood Disturbance Responses of Invertebrate Assemblages in Two Cobble-Boulder Bed Rivers of the Western Cape (G Ractliffe; J Cullis; and A Rooseboom)
The first report, referred to as the Hydraulics Report, outlines the development of a mathematical hydraulic model used to predict bed disturbance under particular flood events. A simple empirical model relates the DRIFT flood class to the intensity of movement (i.e. the total percentage of cobbles that move), and a more detailed model that looks at the probability of movement of individual stones in cobble and boulder bed rivers based on a critical Movability Number that represents the ratio of applied power to required power. The second report, referred to as the Ecological Disturbance Report, considers the relationship between bed disturbance due to flood events and the impact and response of invertebrate assemblages in the two observed cobble and boulder bed rivers in the Western Cape.

Report No: KV210/08
Principles of a Process to Estimate and/or Extrapolate Environmental Flow Requirements (CJ Kleynhans; AL Birkhead; and MD Louw)
The primary objective of this project was to develop a procedure for extrapolating ecological water requirement (EWR) low-flow results from Reserve sites to additional locations (termed hydro-nodes) that have a degree of ecological similarity. The extrapolation procedure refers to hydrological extrapolation by adjusting default parameters in the Desktop Reserve model, and is the current approach for estimating EWRs for additional river locations.

Report No: 1684/1/08
Towards Improved Estimates in Water Resource Assessments: the Use of Hyperspectral and Multispectral Imagery to Classify and Map Vegetation in Southern Africa (M Govender; V Naiken; K Chetty; and H Bulcock)
This project aimed to review hyperspectral remote sensing technology and its application in vegetation and water resource studies; measure and characterise the spectral signatures of selected vegetation classes, for example, indigenous, exotic and declared or candidate streamflow reduction activities for southern Africa; map selected and classified vegetation classes from the research site using hyperspectral imagery; and contribute the results towards an envisaged spectral library for vegetation in southern Africa.

Report No: 1582/1/08
Methods and Software for the Real-Time Implementation of the Ecological Reserve – Explanations and User Manual (DA Hughes; SJL Mallory; and D Louw)
The project and its results are about real-time water management that includes an allowance for the Reserve as well as water users. In that respect the project has been about developing methods whereby the analyses that are typically undertaken using a water resource systems yield model can be given effect to in a real-time operational system. The project has generated a number of deliverable reports that contain the full technical details of all methods and software that have been developed, as well as the revisions that occurred as a result of interactions between the project team and potential users.

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

WATER BY NUMBERS

44 – The age of the June rainfall record that was broken at Paddock weather station along the KwaZulu-Natal coast during recent heavy rains. The weather station recorded 382 mm on June 17, breaking a record which has stood since 1964.

2012 – The year by which the world population will reach 7 billion, according to a US government projection. The world population surpassed 6 billion in 1999, meaning it will only take 13 years to add a billion people.

R5-billion – The funds allocated to Johannesburg Water's project to upgrade and rehabilitate municipal water infrastructure across the city.

11 – The number of dams which provide bulk water to the City of Cape Town and surrounds. The city also has 20 bulk reservoirs and 12 water treatment plants.

115 – The number of municipalities in South Africa where 60% of more households do not have access to water in their dwellings or in their yards. This number is down from 155 in 2007, according to Minister of Provincial and Local Government Sydney Mufamadi.

5 680 ℓ – The volume of water it takes to process one barrel of beer.

September 2008 – The target date for the removal of the remaining 23 083 bucket toilets in the Free State, Northern Cape and Eastern Cape.

950 000 – The number of work opportunities created by the Expanded Public Works Programme between 2004 and 2007. The programme aims to create 1,3 million jobs by 2009.

16 000 – The number of residents in especially informal settlements affected by flooding due to July storms in Cape Town.

Earth impacts linked to human-caused climate change

A new NASA-led study shows human-caused climate change has made an impact on a range of Earth's natural systems, including permafrost thawing, plants blooming earlier across Europe, and lakes declining in productivity in Africa.

"This is the first study to link global temperature data sets, climate model results, and observed changes in a range of physical and biological systems to show the link between humans, climate and impacts," noted Cynthia Rosenzweig of NASA's Goddard Institute for Space Science and lead author of the study, published in *Nature*. Rosenzweig and her colleagues also found the link between human-caused climate change and observed impacts on Earth holds true at the scale of individual continents, particularly in North America, Europe and Africa.

To arrive at the link, the scientists built and analysed a database of more than 29 000 data series pertaining to observed impacts on Earth's natural systems. The data were collected from about 80 studies. Observed impacts included changes to physical systems, such as glaciers shrinking, permafrost melting, and lakes and rivers shrinking.

Biological systems were impacted in a variety of ways, such as leaves unfolding and flowers blooming earlier in the spring. In aquatic environments, plankton and fish are shifting from cold-adapted to warm-adapted communities.

Sediments tell story of China's history of mining

A new geochemical study illuminates 7 000 years of mining and metal use in central China and links these trends to fluctuations in airborne pollution during the Bronze Age and other military and industrial periods in Chinese history.

The study, which could help scientists better understand the accumulative environmental effects of human activity in the region since prehistory times, was published in the July issue of the American Chemical Society's *Environmental Science & Technology* journal.

Using carbon-dated core sediments taken from Liangzhi Lake in Hubei province, Xiang-Dong Li and colleagues were able to track metal deposit trends at the lake dating back to 5 000 BC. Liangzhi Lake is located in an important region in the development of Chinese civilisation.

Beginning in about 3 000 BC concentrations of copper, nickel, lead and zinc in the sediments began to rise, indicating the onset of the Bronze Age in ancient China, the researchers found. In the late Bronze Age (475 BC to 220 AD), an era corresponding with numerous wars, sediment concentrations of copper increased 36% and lead by 82%. Copper and lead were used extensively to make tools and weapons.

To download the full article, go to http://dx.doi.org/10.1021/es702990n

Sediment scrubbing technology tested in US river

Scientists from the University of New Hampshire's (UNH's) Contaminated Sediments Centre have been testing an innovative way to treat polluted sediment in coastal waterways at the edge of the Cocheco River.

Rather than dredging up the sediment, the project team has created a patch black geotextile mats designed to cap and stabilise pollution in place. Over the next two years UNH professors Kevin Gardner and Jeffrey Melton with their team of students will monitor these mats to evaluate the effectiveness of this new approach. "We need to know how these mats behave when they are buried under mud for a few years, compared to how they performed in the laboratory," explained Prof Melton.

The mats comprise a mixture of reactive materials sandwiched between two layers of geotextile fabric, creating a sort of quilt that traps pollutants but allows water to flow through. The reactive 'filling' of this quilt contains three different substances that bind and stabilise different pollutants. One such substance – a patented technology based on a natural form of phosphorus – treats toxic heavy metals associated with industrial pollution, such as lead, copper, zinc and cadmium.

DRC wetlands receives international recognition

An area of the Democratic Republic of Congo containing the largest body of freshwater in Africa has been added to the Ramsar Convention's list of Wetlands of International Importance.

This makes it the largest region ever to be designated as such. At more than 6,5 million hectares, the Ngiri-Tumba-Maingombe area is twice the size of Belgium, and has one of the highest concentrations of biodiversity anywhere in the world. It is also a major carbon sink.

Previously, the largest Ramsar wetland was the 6,3 million hectare Queen Maude Gulf Migratory Bird Sanctuary in Canada. The Congo basin is also the site of the world's third-largest Ramsar wetland, the 5,9 million hectare Grand Affluents area of the Congo River and major tributaries declared earlier this year.

Source: WWF

UN scheme starts to clean up Kenyan capital

A new initiative by the United Nations Environment Programme (UNEP) aims to help the Kenyan government deal with air pollution, waste management and the clean-up of rivers in the country's capital, Nairobi.

The initiative, drawn up by UNEP in cooperation with the government, the city council, donors and the UN Human Settlements Programme (UN-HABITAT), will work in conjunction with the government's Nairobi Metro 2030: A Vision for a World-Class Metropolis plan. "We are determined, through a combination of financial, scientific and technical support to explore how best to assist in the transformation of Nairobi into a vibrant, healthy and functioning capital city in the twenty-first century with the lessons learnt available for other developing metropolitan areas in and outside Kenya," said UNEP Executive Director Achim Steiner.

Among other goals, UNEP aims to assist in finding a new site for the Dandora dumping site, which gets 2 000 t of rubbish each day at present, to a new modern sanitary landfill site in Ruai. Dandora is a major health hazard for people living and working nearby and a key source of pollution into the Nairobi River.

An estimated 300 points of direct discharge of sewage, heavy metals, oils and other pollutants into the Nairobi and Ngong rivers have been identified. One of these sources is the Dagoretti Slaughter House that processes more than 400 animals a day. Under the new initiative, waste will instead be used to fuel a biogas power plant, whose output has been estimated to have the potential of generating enough off-grid electricity for more than 1 000 homes in the surrounding area.

The project also includes plans for the rehabilitation of the Nairobi Dam with the first element being an Environmental Impact Assessment of the proposed engineering interventions for the restoration works.

Concrete jungle healthier for frogs

Frogs living in urban environments seem to be better off than their counterparts living in farm areas, a US study has found.

Zoologists from the University of Florida (UF) found that toads in suburban areas are less likely to suffer from reproductive system abnormalities than toads near farms – where some had both testes and ovaries. "As you increase agriculture, you have an increasing number of abnormalities," noted Prof of Zoology Lou Guillette.

Several past studies have suggested a link between herbicides commonly used in farming and sexual abnormalities in tadpoles and frogs. The UF study is reportedly the first study to compare abnormalities in frogs from heavily farmed areas with frogs from partially farmed and completely suburban areas. In so doing, it highlights the difference between the impact of agriculture versus development.

"Our study is the first to explicitly ask, of these two areas of human disturbance, do we see a greater proportion of abnormal animals in one versus another," Prof Guillette said. "Because the results implicate agriculture, future research can narrow the focus to agricultural chemicals."

New weapon in fight against corruption

The World Bank Institute (WBI) has released a practical guide to help companies faced with corruption in the public procurement arena.

The guide, *Fighting Corruption through Collective Action – A Guide for Business*, was created to help companies fight back against the insidious impacts of corruption and, along with its companion Web portal, outlines proven methods to fight marketplace corruption through collective action between business and other stakeholders.

"The purpose of this guide is to establish a level playing field and assist firms who would otherwise have to abandon doing business in a corrupt environment," reported Djordjija Petkoski, WBI programme leader. "It should become a staple component of a company's approach to promoting ethics and to managing the risk of fraud and corruption. Equally, the guide should also be of interest to enlightened governments and other organisations which share the goals of eliminating corruption from business dealings."

For more information, visit: www.fightingcorruption.org

Spotlight on international water careers

A new publication, which places the spotlight on careers in the international water sector, is now available.

A World of Opportunities – Working in the International Water Sector, is a collaborative effort from the International Water Association, *Water21* magazine and the my-water-career.com website. The annual publication aims to provide valuable information for those making early career decisions. Containing articles covering key issues affecting the water sector and profiles of individuals working within it, the publication highlights the significance of the sector and the diversity of career opportunities that exist.

To request a free copy go to www.survey.bris.ac.uk/iwa/career-book

Bill Harding

Algal scum, or the so-called 'pea soup effect' is a clear symptom of severe eutrophication.

Microscope Refocused on SA Water Quality Threat

A new guide and associated tools developed with funds from the Water Research Commission (WRC) hopes to improve the management of one of the greatest threats to South Africa's water resources. Lani van Vuuren reports.

Eutrophication is a persistent water quality problem, plaguing water resource managers around the globe. In South Africa, eutrophication has been recognised as a priority water quality problem for over 30 years. The country has some of the most nutrient enriched water bodies in the world, highly problematic considering that, as a water scarce country, South Africa is hugely dependent on water stored in dams.

At present, 35% of the total storage available in our dams is either eutrophic (very nutrient enriched) or hypertrophic (extremely nutrient enriched). "If we add this to the number of dams in which the conditions are approaching eutrophic, then a total of 60% of our stored water is impaired," reports Dr Bill Harding of DH Environmental Consulting and co-author of ***A Guide to Catchment-Scale Eutrophication Assessments for Rivers, Reservoirs and Lacustrine Wetlands***, which has just been published by the WRC.

A PROLIFIC PROBLEM

Why is eutrophication so prolific in South Africa? Eutrophication assessment guide co-author Nico Rossouw of Ninham Shand explains that over the years, the management of the country's water has evolved to maximise the use

of this scarce resource. This includes the treatment and disposal of wastewater effluent back into rivers for further use by downstream users.

"However, domestic wastewater is rich in nutrients and not all wastewater treatment works are equipped or operated to efficiently remove phosphates. The result is high nutrient loads entering our rivers and reservoirs resulting in eutrophication of those water bodies," Rossouw tells ***the Water Wheel***. "In some cases, treated wastewater is the main or only inflow into a river or reservoir during the low rainfall months."

"In some cases, treated wastewater is the main or only inflow into a river or reservoir during the low rainfall months."

For this reason, eutrophication generally tends to be associated with areas where South Africa's population is concentrated and large volumes of wastewater are generated. (Hartbeespoort Dam, which suffers from extremely hypertrophic conditions, receives around 175 t/year of phosphates from more than a dozen wastewater treatment plants in the catchment). Rossouw adds that South Africa's abundant sunshine and warm water temperatures also create ideal conditions for algae to flourish.

SHRINKING EXPERTISE

Until the mid-1980s, South Africa was a world leader in research in the field of eutrophication. Unfortunately, this advantage has since been lost due to eutrophication being afforded low priority status by government, which led to the termination of funding for research in this field. Many of the researchers involved in early eutrophication research have since moved into better research fields, into consultation or have emigrated. As a result, appropriate management strategies directed against eutrophication have been seriously constrained by a widespread lack of understanding of the problem, particularly at the decision-making level.

The new millennium has seen renewed interest in eutrophication management and research, thanks largely to a WRC report on eutrophication-related policy and research needs in South Africa, authored by Dr Danny Walmsley, and published in 2000. Dr Walmsley found that the lack of input to policy development, monitoring, research, reporting and capacity development had diminished South Africa's ability to deal with the problem.

"The situation is now being reversed, with investment in eutrophication research improving and processes being put in place to close the gap between setting policies for eutrophication management and implementing management actions to deal with the problem," reports Rossouw. Unfortunately, according to Dr Harding, the scope remains somewhat fragmented, with the development of human capacity with understanding of the problem still lacking. "Critically, public awareness and understanding are not being developed to the same level as has been achieved in Europe, Australia and the US, where we are now seeing court action related to eutrophication of water bodies," he notes.

TURNING THE TIDE

The latest WRC eutrophication assessment guide is aligned with present water resource management policies and procedures endorsed by the Department of Water Affairs & Forestry (DWAF). The document sets out the key components of an investigation required to assess the eutrophication status of a catchment or sub-catchment, with a view to developing management options that take into account the needs and aspirations of stakeholders and also the constraints imposed on a particular catchment.

It is structured around six management questions, each of which is designed to

LEVELS OF EUTROPHICATION:

Oligotrophic: Indicates the presence of low levels of nutrients and no water quality problems.
Mesotrophic: Indicates intermediate levels of nutrient levels, with emerging signs of water quality problems.
Eutrophic: Indicates high levels of nutrients and an increasing frequency of water quality problems
Hypertrophic: Indicates excessive levels where plant production is governed by physical factors. Water quality problems are almost continuous.

Lani van Vuuren

Rietvlei Dam, located in the Crocodile West-Marico water management area (WMA), is also considered hypetrophic. Most of the dams with eutrophication problems are situated in this WMA.

Bill Harding

Fish deaths due to extreme hypertrophic conditions is common, mostly as a result of toxic cyanobacteria (blue-green algae).

EUTROPHICATION IN SOUTH AFRICA – A SHORT HISTORY

1950s-1960s: The first impacts of eutrophication became apparent in the 1950s, reaching problematic levels in the 1960s.

1970s: Eutrophication, as a serious water problem is brought to the attention of water resource managers. Research by the National Institute for Water Research resulted in the publication of the first review of eutrophication and initial guidelines for its control. This is followed by an investigation into eutrophication problems in several South African reservoirs. This research results in a second report, providing guidelines for the control of eutrophication in South Africa.

1980s: The Department of Water Affairs & Forestry (DWAF) issues a special phosphorus standard (1 mg P/ℓ) on effluent discharged into sensitive catchments. The knowledge base is extended through various research studies, for example, the Hartbeespoort Dam research project, nuisance algae at Vaal Dam and Barrage; eutrophication studies at Roodeplaat, Bloemhof and Hartbeespoort dams, and nuisance algae and treatment studies at Balkfontein.

1990s: Funding for large multidisciplinary research on eutrophication declines and research and training initiatives at universities become eroded. Eutrophication-related technical and scientific publications are almost non-existent during this period. As a result, decision-makers are not exposed to information on the subject. Capacity to manage eutrophication is reduced due to staff transformation and high staff turnover.

2000-present: A Water Research Commission (WRC) funded assessment by Dr Danny Walmsley into South Africa's policy towards eutrophication (WRC Report No: **KV129/00**) found that the country's policy and approach to eutrophication control has been inadequate over the last 20 years. A lack of input into policy development, monitoring, research, reporting and capacity development has greatly diminished the country's ability to deal with the problem. As a result, eutrophication management starts receiving considerably more attention by DWAF, supported by initiatives from the WRC. The National Eutrophication Monitoring Programme (www.dwaf.gov.za/iwqs/eutrophication/NEMP/default.htm) is designed in a joint initiative between DWAF and the WRC. This programme is still yielding data and information on eutrophication status of a large number of water bodies in South Africa.

be answered through the execution of a corresponding eutrophication assessment task:

- Characterisation of current eutrophication status and historical trends;
- Engagement with water-related institutions and stakeholders;
- Formulation and recording of eutrophication-related water quality issues, concerns, problems and opportunities;
- Projection of eutrophication-related water quality impacts of future water-related development scenarios;
- Formulation and prioritisation of eutrophication management options; and
- Monitoring and auditing of the implementation of eutrophication management strategies.

ON-LINE ASSISTANCE

Along with the guide, an Internet-based eutrophication assessment guide has been developed (www.dhec.co.za/neap/). The so-called nutrient enrichment assessment protocol (NEAP) has been designed as a simple-to-use, phosphorus-based, eutrophication screening tool for open water environments (lakes and dams). As such it provides a non-data intensive means of determining the trophic status (degree of nutrient enrichment) of water bodies. As a screening tool it can be used to inform options for management by providing a rapid approximation of the level of eutrophication in a particular reservoir. Despite the simplicity of the tool, it is extremely important that NEAP users understand that eutrophication is not simply a function of phosphorus loads and concentrations, but that a wide variety of biophysical and chemical factors can enhance or constrain the observed level of eutrophication in a particular water body.

Dr Harding reports that the use of NEAP has been promising. Interestingly there has been interest not only from South Africa, but also from overseas. In fact, more international users are registered to use the product than South Africans at present. "The value of a product such as NEAP is that it support the development of an understanding of how lakes and reservoirs behave – on multiple levels from hydromorphology to nutrient assimilation."

SHORT COURSE

The need to rebuild capacity for the assessment and management of eutrophication provided the motivation behind the third tool developed as part of this project, namely the design of an eutrophication short course based on the eutrophication assessment guide. Course material has been prepared mainly for water resource managers and practitioners as well as for freshwater scientists and, secondly, for students at tertiary training institutions.

Level of eutrophication in reservoirs and lakes in developed vs developing countries

Area	Percentage of lakes/ reservoirs impaired by eutrophication
Asia	54%
Europe	53%
North America	48%
South America	41%
Africa	28%
South Africa	35%

The course provides participants with a broad overview of eutrophication and nutrient enrichment, especially in South African rivers, dams and lacustrine wetlands. Furthermore, it imparts knowledge on approaches to deal with the problem through legislation and the basic approach and steps needed to undertake a catchment-scale eutrophication assessment study.

The research team believes that the outcomes of this project can contribute greatly to rebuilding the necessary capacity in South Africa to deal with eutrophication effectively. "Eutrophication problems occur in all parts of the country, and from discussions with DWAF officials it is clear that the regional offices who deal with these problems experience serious capacity constraints due to a high turnover in junior water quality managers and an exodus of experienced water quality managers from the department in recent years," reports Rossouw. "The eutrophication assessment guide and its supporting tools will certainly help less experienced staff, not only in DWAF but also in local authorities, to take a first stab at assessing an eutrophication problem, identifying some of the root causes and drawing up a short list of possible management interventions. It also provides guidance on when it is appropriate to involve eutrophication experts to investigate or advise on specific problem areas."

Besides being of immediate value, it is hoped that the outcomes of this project will serve as a platform for further development of eutrophication assessment and capacity building tools.

To order the eutrophication assessment guide, **Report No: TT 352/08** or related report, ***The Determination of Annual Phosphorus Loading Limits for South African Dams*** (**Report No: 1687/1/08**) contact Publications at Tel: (012) 330-0340, Fax: (012) 331-2565 or E-mail: www.wrc.org.za

WHY THE CONCERN OVER EUTROPHICATION?

Eutrophication refers to the enrichment of water bodies (such as dams and lakes) with plant nutrients, particularly phosphorus and nitrogen compounds. It is a natural phenomenon that normally occurs during the life of an impoundment or a lake and can take thousands of years to occur. However, agricultural and urban runoff, municipal and industrial wastewater effluents, and septic tank leach fields all contribute plant nutrients, as well as other pollutants, to catchment areas, which accelerate the eutrophication of lakes and dams.

Water bodies that are eutrophic (nutrient enriched) experience an increase in algae (especially cyanobacterial or blue-green algae which can be toxic) and weedy aquatic plants, such as water hyacinth, which choke waterways. Extreme and prolonged eutrophication leads to the deterioration of water quality, taste and odour problems, oxygen depletion, and decline of more desirable fish species. The resultant prolific growth in algae also disrupts water treatment, which means the water is more expensive and difficult to treat for drinking water purposes. Nutrient enrichment, therefore, remains one of the leading causes of water quality impairment in the world.

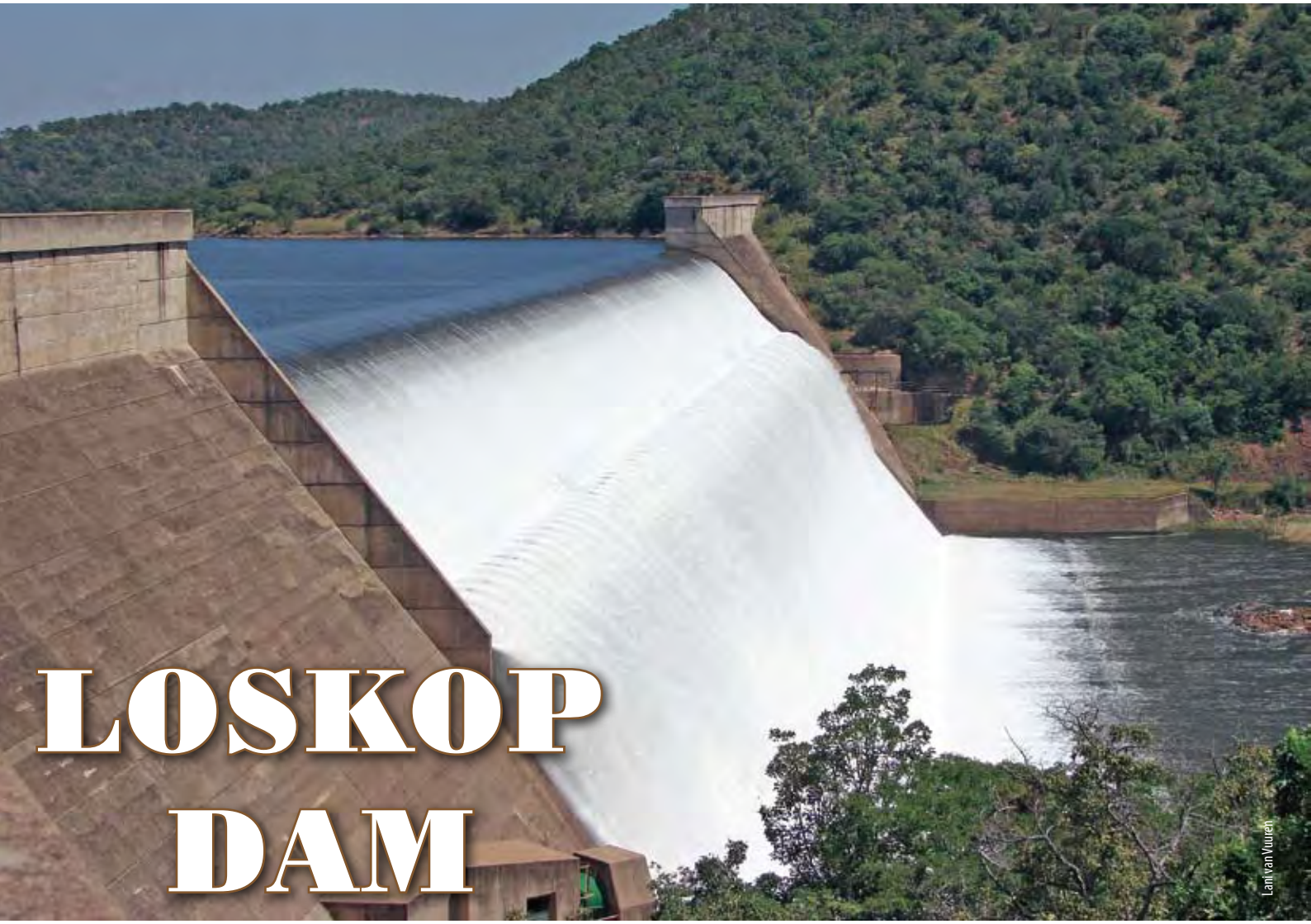
Source: DWAF

Heidi Snyman

Hartbeespoort Dam is arguably one of the most notorious hypertrophic dams in South Africa. In March 2003, the dam experienced one of the worst algae blooms in its history.

Lani van Vuuren

Even during winter water hyacinth plagues Pretoria's Roodeplaat Dam.



LOSKOP DAM

– Early Local Engineering Ingenuity

Despite being constructed more than 70 years ago, the Loskop Dam, situated across a gorge on the Olifants River, about 32 km south of Groblersdal, in Mpumalanga, remains one of the largest dams in South Africa. Lani van Vuuren reports.

The history of the Loskop Dam can be traced back to the 1840s when the Voortrekkers settled in the Kruis River valley not far from the present dam site. The first farms in the Olifants River valley, including Lagersdrift and Kalkfontein, were pegged out as long ago as 1886. Back then, the farmers cultivated mainly wheat under dry-land conditions.

Notwithstanding the establishment of these farms, due to malaria and cattle diseases like East Coast fever, initial development was slow until the turn of the nineteenth century. In the early twentieth century, many farmers trekked with their cattle from the Highveld to the Olifants River valley during the winter. Each winter they stayed a little longer until they eventually

settled in the area in greater numbers. This was particularly during the years between 1917 and 1924.

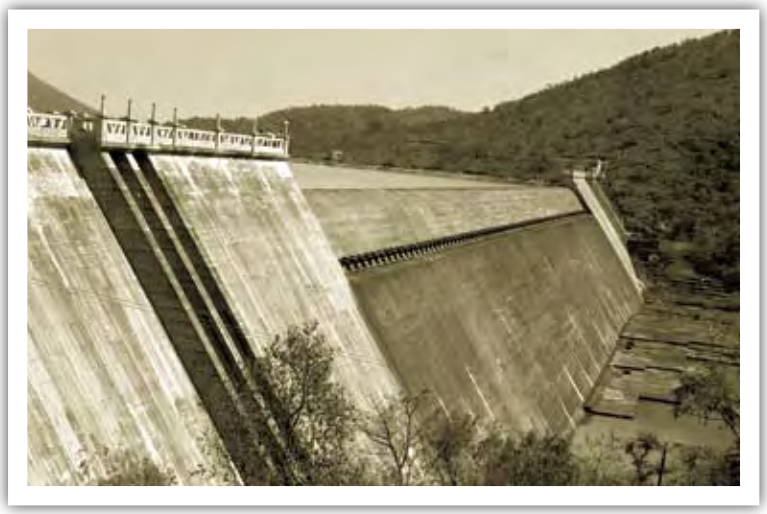
THE RISE OF SMALL IRRIGATION SCHEMES

It was in 1917 that the first private dam in the area was completed on the farm Rooikraal with government assistance. Thanks to irrigation, the wheat crop on this farm increased from 150 to 8 000 bags a year. Around 1925, other small irrigation schemes were completed involving both weirs and pumping water from the river. This led to the establishment of the Hereford Irrigation Board to serve an area of about 2 140 ha which was situated about 10 km downstream of the present Loskop Dam.

The history of the Loskop Dam can be traced back to the 1840s when the Voortrekkers settled in the Kruis River valley not far from the present dam site.

The proposed Hereford Scheme included an improvement of the diversion weir at Kameeldoring, and a 41 km-long canal extending as far as the Moses River. After a loan of R70 000 was granted by the Land Bank, work started during 1928 under the supervision of the Department of Irrigation. The various contracts were completed in 1930.

The early success of this scheme gave rise to a petition by farmers for the establishment of the Loskop Irrigation District. The old Transvaal Irrigation Department had undertaken a reconnaissance survey of such an irrigation scheme on the Olifants River between 1905 and 1907. However, back then it was recommended that an irrigation scheme should not be implemented until the valley was more densely populated, and not before there



DWAF/eWISA

The original dam wall of the Loskop Dam, completed in 1938, was 45 m high.

DWAF/eWISA

A historical downstream view of the original Loskop Dam prior to the raising of the wall.

DWAF/eWISA

A historical photograph of the main canal flowing from the Loskop Dam. The total length of the canals from the Loskop Irrigation Scheme is 480 km.

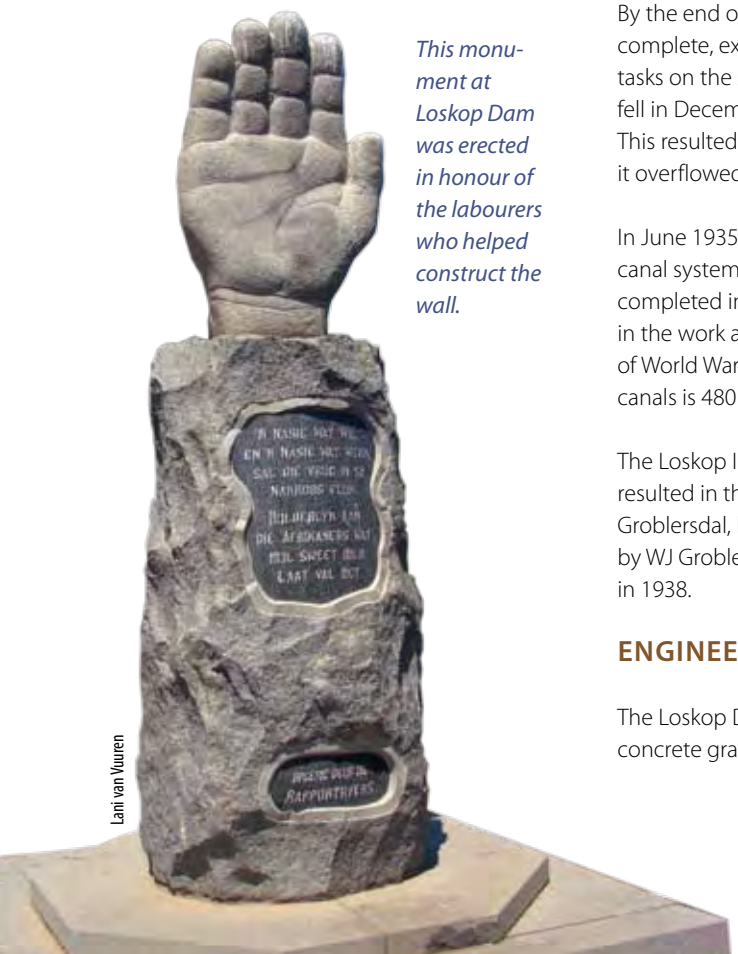
was the prospect of a railway service to the area.

IRRIGATION SCHEME INVESTIGATED

In 1929, the Minister of Irrigation instructed the Irrigation Commission to investigate the possibility of the Loskop Irrigation Scheme. After studying the position, the Commission recommended that the Hereford Scheme, which was then under construction, be studied further together with other private schemes, which were developing, before approval was given to a larger scheme at Loskop.

A topographical and soil survey of the dam basin was undertaken during 1933. Eventually the Department of Irrigation and the Irrigation Commission brought out various reports on the success of agricultural crops under the Hereford Scheme and a special sub-committee of Cabinet decided to recommend the scheme to Parliament.

Interestingly, the scheme was placed on the government's Loan Estimates for the year 1934-35, without any recommendations of the Commission having been obtained as to whether it should be constructed or not. The estimate cost of the entire project was £1,5-million.



Lani van Vuuren

This monument at Loskop Dam was erected in honour of the labourers who helped construct the wall.

CONSTRUCTION OF THE DAM

Construction of the Loskop Dam on the farms Loskop and Vergelegen started in 1934. As was the case with many other government projects at the time only white labour was used. Initially only married white men were employed on the Loskop Dam construction site. They were paid five shillings a day and provided with free accommodation, food and medical attention.

The number of labourers employed at the end of March 1935 was 460 men. Throughout 1935 and 1936 the Director of Irrigation noted in his report that there was a shortage of labour, especially concerning the construction of the Loskop Dam. The department then asked the Department of Labour to allow it to employ single white men on the project as well.

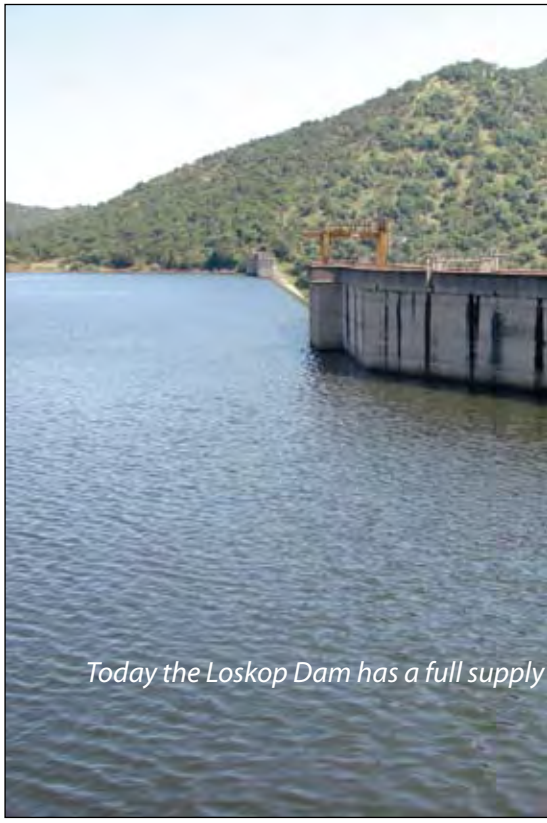
By the end of 1937 the dam was nearly complete, except for a number of minor tasks on the superstructure. Good rains fell in December 1937 and January 1938. This resulted in the dam being filled and it overflowed in January 1938.

In June 1935, a start was made on the canal system, which was eventually completed in 1948, after an interruption in the work as a result of the outbreak of World War II. The total length of the canals is 480 km.

The Loskop Irrigation Scheme also resulted in the establishment of a town, Groblersdal, laid out on a farm owned by WJ Grobler. The town was proclaimed in 1938.

ENGINEERING INGENUITY

The Loskop Dam comprises a mass concrete gravity wall with an ogee crest spillway. The original wall was 45 m high. The dam is well known in engineering circles as the first dam where the so-called Roberts splitter system – an energy-dissipating step and splitter system devised by Lt Col DF Roberts – was used. Lt Col Roberts was the resident engineer at the Department of Irrigation's very first hydraulics laboratory near the dam site. His splitter system



Today the Loskop Dam has a full supply

LOSKOP DAM FACTS & FIGURES

Year of completion	
Purpose	
River	
Nearest town and province	
Type	
Net storage capacity	
Wall height above lowest foundation	
Crest length	
Material content of dam wall (original and raised)	
Type of spillway	
Capacity of spillway	
Surface area of dam at full supply level	
Owner, design and construction	

Source: Loskop Irrigation Board

capacity of 362 million m³.

Lani van Vuuren

	1938 (raised in 1979)
	Irrigation, domestic, industrial
	Olifants River
	Groblersdal, Mpumalanga
	Mass concrete
	348 million m³
	54 m
	506 m
	415 000 m³
	Uncontrolled
	7 750 m³/s
	2 350 ha
	DWAF

was used on the downstream face of the Loskop Dam wall to dissipate the kinetic energy of the overflowing water.

Following this successful application, this system has been widely adopted in South Africa, including on the Nagle and Gariep dams. It has also been applied abroad, for example, on the Victoria Dam in Sri Lanka.

RAISING OF THE DAM WALL

Development in the Witbank-Middelburg area necessitated the raising of the dam wall so that the portion of the assured yield which had in the meantime become affected as a result of the construction of upstream dams such as Rondebosch, Witbank and Doornpoort dams could be restored. By 1971, when the recommendation to raise the dam wall was made, the Loskop Dam system of canals served about 25 000 ha of farmlands.

Between 1974 and 1980 the dam wall was raised by nine metres to a height of 54 m above the lowest foundation level. The geographic formations found underneath the dam made for an interesting engineering project.

The dam is underlain by rhyolitic lava of the Rooiberg Group. Excavation to competent foundation rock was shallow on the left flank and in the river section. However, on the right flank close fracturing and deep weathering had necessitated deep excavation for the old right-flank section.

It was not until the investigation for the raising that the presence of a wide fault zone just downstream of the right flank was discovered. To ensure stability of the right flank, the raised wall was kinked in a downstream direction to cross the fault zone in the shortest possible way. Excavation in the fault zone was up to 16 m deep, but the longer, upper end of the wall could be founded on competent rock at shallow depth. Today, the dam has a total crest length (of which the spillway section is 244 m long) of 506 m.

In the design of the dam provision was made for crest gates in order to facilitate the raising of the dam wall by another four metres at a future stage. The full supply capacity of the dam is 362 million m³. The dam has been constructed to accommodate a design flood of 2 886 m³/s (a 1:200 year flood).

LOOSE HILL OR LOST HEAD?

Urban legends abound when it comes to where the Loskop Dam got its name. The conventional version is that the dam was named after one of the farms it inundated. It is said that 'Loskop' actually referrs to a lone hill in the veldt which was submerged under the dam's water. The story told by tourist guides, however, is that when resident engineer Lt Col DF Roberts died his head was buried on top of a man-made island on the far west side of the dam, and that that is where the dam actually got its name.

HOLY BURIAL GROUND

The ashes of Lt Col Robert were originally buried on an island in the dam. As the raising of the wall was to result in the inundation of the island, the ashes were removed and reentered in a niche on the left flank of the dam wall.

At present, the Loskop Water Scheme consists of 667 properties with an average scheduling of 25,7 ha each. Wheat, vegetables, tobacco, peanuts, cotton, and citrus fruit are cultivated. Furthermore, water from the dam supplies the Hereford Irrigation Board, the Olifants River Irrigation Board, as well as the Groblersdal and Marble Hall municipalities.

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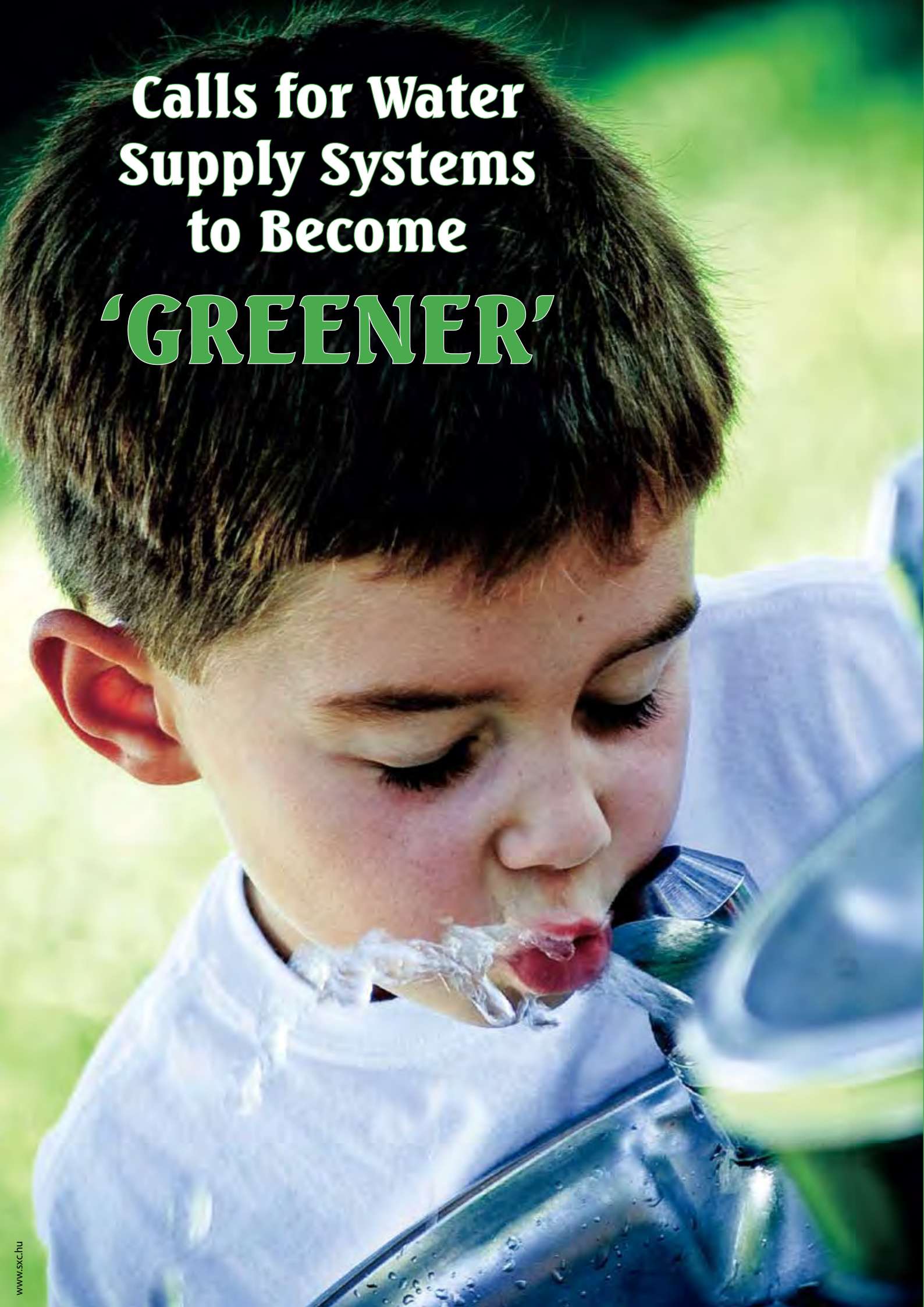
www.aatravel.co.za/staticnew/towns/loskop_dam.html

Calls for Water Supply Systems to Become 'GREENER'



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More pressure will be placed on water services providers in future to improve the sustainability of urban water distribution systems, especially in lieu of pressing climate change. This was one of the main messages emanating from the 10th Annual Water Distribution Analysis (WDSA) Conference, held in the Kruger National Park in August. Lani van Vuuren reports.

The latest international WDSA conference, considered one of the foremost forums on water distribution systems in the world, was the first to be held outside the US. It attracted around 200 experts from all over the world, including the USA, Australia, Canada and the UK. Among others the conference encouraged and fostered debate on new ways to supply drinking water, control distribution system water quality and improve and maintain safe drinking water in every part of the world.

Delegates heard how the sustainability of urban infrastructure is starting to attract significant attention, especially in developed countries. The water supply industry's present focus is on the potential ways in which the effects of climate change will influence the supply of water, for example, through changes in the hydrologic cycle and extreme events (droughts and floods). This is especially so because the effects of climate change on water distribution systems are not well known.

COMPLEX FUTURE CHALLENGES

However, there are increased calls for water services authorities to pay more attention to their water distribution systems' own contribution to global warming. "Modern drinking water and wastewater treatment systems are considered among the top five engineering achievements of the twentieth century," reported Dr Steven Buchberger, Interim Department Head of Civil & Environmental Engineering at the University of Cincinnati, in the US. "Countries, especially those in the developed world who have vast networks of ageing infrastructure, are faced with the challenge of repairing and restoring existing water distribution systems (and installing new systems), in a manner that promotes economic and environmental sustainability while protecting human health and preserving the environment for future generations."

"This daunting assignment is exacerbated by the emergence and convergence of global trends involving changing climate, shifting demographics (i.e. urbanisation), economic transformations and evolving regulations," noted Dr Buchberger. To mitigate these challenges, the US Environmental Protection Agency, for example, has launched the Water Resources Adaptation Programme for Infrastructure to identify and evaluate innovative approaches to improve the planning, design, operation and maintenance of the country's water resources infrastructure going forward.

"Countries... are faced with the challenge of repairing and restoring existing water distribution systems ... in a manner that promotes economic and environmental sustainability while protecting human health and preserving the environment for future generations."

How do water distribution systems contribute to climate change? According to Prof Angus Simpson of the School of Civil, Environmental and Mining Engineering at the University of Adelaide, Australia, the manufacture, transport, installation and decommissioning of water distribution systems all lead to the production of greenhouse gases, which have been blamed for global warming. In addition, greenhouse gases arise from pumping during operations when electricity is derived from burning fossil fuels.

MULTI-OBJECTIVE APPROACH

Thus, the water supply sector has been called upon to adopt a more 'multi-objective' approach. "The traditional methods of optimising water distribution systems consider local concerns such as the cost of pipe, pump and tank upgrades, and meeting minimum pressure head and maximum velocity requirements," explained Dr Ives Filion, Assistant Professor at the Department of Civil Engineering at Queen's University in Ontario, Canada. "Although these concerns remain important, engineers are beginning to realise that environmental impact should also be included in water distribution system optimisation. This is owing to the growing recognition that

Dr Steven Buchberger, Interim Department Head of Civil & Environmental Engineering at the University of Cincinnati was one of the speakers at the recent Water Distribution Systems Analysis conference.

Lani van Vuuren

"Engineers are beginning to realise that environmental impact should also be included in water distribution system optimisation. This is owing to the growing recognition that water distribution systems depend on regional energy and production systems in the construction, operation and disposal stages."

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Dr Filion noted that this dependency led to environmental impacts that manifested themselves outside the physical and jurisdictional boundaries of a water distribution system over time. "Therefore, added to traditional local concerns of minimising cost and meeting hydraulic requirements are regional and global concerns of material and energy use, greenhouse gas emissions, and toxic releases associated with the production of network components and their continued operation."

WATER DISTRIBUTION AND CARBON TRADING

One of the measures to mitigate global warming is carbon emissions trading schemes. Under an emission or carbon trading scheme, some businesses may need to buy permits to cover the greenhouse gases they emit, while others may be able to sell excess permits they own on the carbon market, if they can reduce their emissions by employing advanced technology. Prof Simpson, who presented a paper on water distribution system accounting for a range of future possible carbon prices, maintained that many industries, including the water supply industry, would be affected by the price of carbon. "To meet this challenge, water suppliers will have to consider a new paradigm for the design of water distribution systems under an emission trading scheme."

The Australian government, for example, has adopted a carbon trading approach, and currently, a national emissions trading scheme is being developed to start no later than 2010. What does this mean for water distribution systems? "Water suppliers will have to look at, for example, the best combination of pump size and pipe size to deliver the minimum average peak-day flow while minimising the total cost and greenhouse gas emissions of the network during its design life," noted Prof Simpson. Research by the professor and his team has also shown that different pump materials contribute different levels of greenhouse gases into the atmosphere, with cast iron pipes generally contributing more to greenhouse gases in its manufacture than polyvinyl chloride (PVC) pipes.

In view of dwindling fresh water resources amid an ever growing demand for water, it is clear that in the near future supplying water will be about much more than building a pipeline.

Selection of pipe sizes and materials will in future be determined by the contribution to greenhouse gases and environmental degradation, not just based on cost.

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Weeding out Water Wastage in Irrigation Canals

Aquatic weeds continue to choke many of South Africa's irrigation canals and are among the main reasons why many schemes continue to remain water inefficient.

The largest consumer of water in South Africa, agriculture uses approximately 62% of the total national water supply to irrigate crops. At present, a million hectares from a potential 1,4 million hectares is under irrigation. South Africa has thousands of kilometres of canals criss-crossing the countryside from which the majority of the irrigation schemes receive their water supply. These canals are both lined and earthen structures.

Many of these water conveyance structures are plagued by aquatic weeds, such as filamentous algae and aquatic macrophytes. Following the winter months, the increasing day length and consequent rise in ambient temperatures result in increased water temperature and light penetration into water bodies. Optimum environmental conditions, and the presence of sufficient plant nutrients (phosphates and nitrates) – usually the result of pollution – lead to an increase in aquatic weed biomass of affected irrigation canals.

Envirokonsult Director, Kobus du Plessis, who has studied this phenomenon over the years, reports that aquatic weeds proliferate in a relatively short period to form dense masses of organic material that result in substantial operational problems with economic implications in water supply systems. "Large volumes of the design capacity of canals and other water conveyance structures are displaced by plant biomass."

It is estimated that a minimum of 20% to 30% of the water supplied to the irrigation sector is lost due to leakages out of conveyance structures, evaporation, evapotranspiration, spillage and flooding, among others. Some older schemes have, and still are, recording periodic losses of up to 70%. As aquatic weeds contribute significantly to these water losses this problem is also addressed by the Department of Water Affairs and Forestry's Water Conservation and Water Demand Management Strategy.

"Based on current agricultural tariffs, a mere 10% saving in the current water loss (taken as 25% of usage by the agricultural sector), can result in savings of at least R82-million per annum (savings on crop losses not included) and release more than 500 million m^3 of water for use by other sectors," notes Du Plessis.

OPERATIONAL PROBLEMS

Aquatic weeds cause a host of operational problems in water conveyance structures, such as reducing hydraulic capacity and flow speed in affected

canals – some to such a degree that the supplied water cannot reach the terminal point of the canal system. Aquatic weeds can replace significant volumes of the capacity of a canal. This results in overflows that may contribute to losses out of the system, as well as crop losses due to under-supply of water to irrigators.

Another problem is that of overestimation of the volume of water supplied to the user. As aquatic weed biomass replaces water in a canal, a higher volume of water is measured at measuring devices at what is in fact passing at that specific location. This overestimation of flow makes the optimal operation of water supply a difficult task as less water is passing at a specific point as what is measured. To compensate for these artificially high water levels, more water is often released into the system, giving rise to flooding and subsequent water loss.

Other problems include impediment of sluice gates working at dividing structures, water logging of long-weirs, structure failure of concrete-lined irrigation canals due to flooding, and blocking of irrigation systems and filters at water purification works by aquatic weed fragments.

CONTROLLING AQUATIC WEEDS

Historically, aquatic weed control measures applied in South Africa have been symptomatically orientated. The problem is thus treated only once it visibly influences the operation of the system. Different control options have been investigated over the years and implemented with varying levels of success. One of the greatest challenges is finding an option that takes the canal out of operation for as short a time as possible.

Mechanical removal has been a popular method, however, it is expensive and labour intensive. It has also been found that in peak summer months the biomass cannot be removed efficiently. "To date, attempts to control the biomass mechanically in systems that continuously supply water seem to be relatively unsuccessful and uneconomic," says Du Plessis.

In terms of chemical control methods the so-called 'lower pH method' has been favoured using mainly copper sulphate. Local herbicidal options are limited to the treatment of aquatic weeds with herbicides/algaecides with mainly copper as active ingredient, as well as a herbicide with diquat as active ingredient. Unfortunately, both substances have their limitations under local conditions. The copper products are more effective on algae than on macrophytes, while the diquat-based product is more effective on macrophytes than algae.

Envirokonsult

Aquatic weeds are choking many of South Africa's irrigation canals severely affecting performance and water efficiency.

Envirokonsult

Physical cleanup of aquatic weeds and algae in water conveyance structures is an expensive, labour-intensive process.

Envirokonsult

Water loss and structural damage due to flooding can occur as a result of aquatic weeds in irrigation canals.

Envirokonsult

Typical dosing with the water-soluble aldehyde.

Envirokonsult

A South African irrigation canal following acrolein treatment.

Other algaecides and herbicides with heavy metals as active ingredient were also tested over the years. But the problems associated with these products were many as their usage resulted in the build up of toxic residues in irrigation soils, necessitated downtime for the canals as well as withholding periods from crops. Biological methods, such as the introduction of sterile Chinese grass carp, has also been investigated by Du Plessis's team.

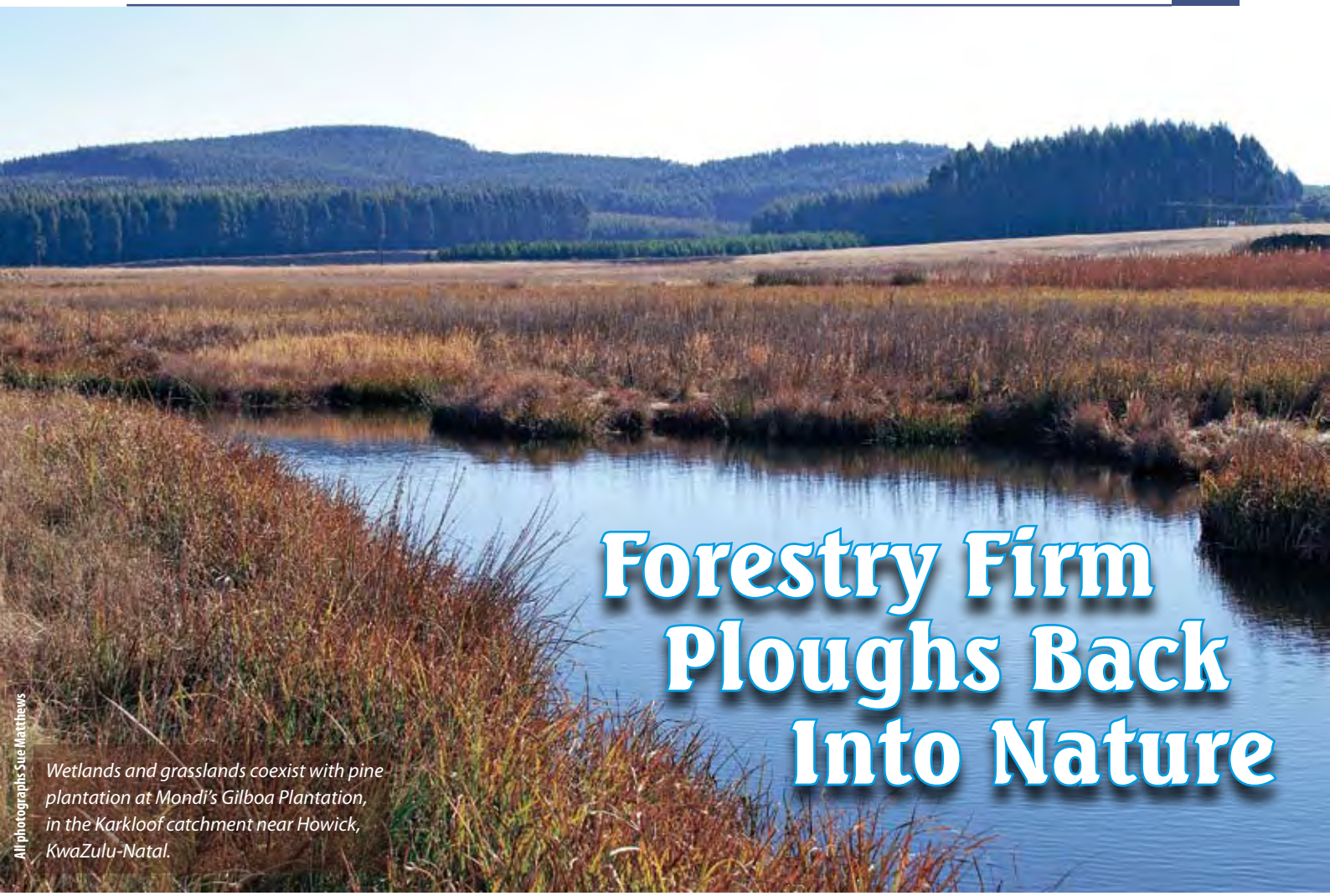
LOOKING AT ALTERNATIVES

An alternative herbicide has now been introduced to the South African market from the United States. "This water-soluble aldehyde, which comes in liquid form and has acrolein as its active ingredient, can be used in operational systems without interrupting irrigation water deliveries, and is characterised by superior effectiveness and quick dissipation without any residue," reports Du Plessis.

"What makes acrolein a good prospective is that the product does not accumulate in crops, soil or groundwater and can be applied directly to crops. Furthermore, acrolein (an organic molecule) dissipates to harmless carbon dioxide and water as end products, which makes it more environmentally friendly." It is also effective on both algae and macrophytes and is used widely in the United States, Australia, Canada, and other countries with similar problems.

Scientific trials with the new product have been completed successfully in Roodeplaat and Hartbeespoort canal systems. In the case of Hartbeespoort water losses was cut by 17% and the water saved could be made available to new mines in the area which are expected to inject more than R1-billion into the local economy – something that would have been lost without the available water.

The new product is currently in the registration process. It is hoped that it will find large-scale application to remove aquatic weeds from water conveyance systems and bring about the necessary water savings to the irrigation sector.



Forestry Firm Ploughs Back Into Nature

All photographs Sue Matthews

Wetlands and grasslands coexist with pine plantation at Mondi's Gilboa Plantation, in the Karkloof catchment near Howick, KwaZulu-Natal.

International paper and packaging firm Mondi has reaffirmed its commitment to reducing its ecological footprint following the signing of an agreement to extend the company's funding of the Mondi Wetlands Programme for another five years. Sue Matthews reports.

South Africa's forestry industry has come in for plenty of criticism over the last few decades. This is mainly because plantations of pines and other invasive alien trees use a lot more water than the natural vegetation they replace, so they reduce the flow of rivers, with knock-on impacts for water supplies and aquatic ecosystems. But the industry has taken a proactive stance in addressing these concerns, laying the groundwork for other sectors to follow suit.

"This valley used to be planted wall to wall," says Peter Gardiner, sweeping his hand over the Gilboa Plantation, set in the Karkloof catchment near Howick in KwaZulu-Natal. "Since Mondi acquired it ten years ago, trees have been removed from the riparian zones and wetlands, and rehabilitation measures have been taken to address erosion. These steps are not only releasing water to downstream users, but helping to restore water-courses as biodiversity corridors."

Gardiner is Mondi's Natural Resources Manager, and was speaking at the signing ceremony for an agreement to extend the company's funding of the Mondi Wetlands Programme for another five years. The programme was established in 1991 by WWF and the Wildlife and Environment Society of South Africa (WESSA), initially with the financial support of Rennies. Mondi took over as principal funder in 2000, and to mark their continued commitment a group of journalists were taken on a field trip to Gilboa to see wetland rehabilitation in practice.

Clearly, any measures that increase the availability of water have the potential to translate into real benefits. The plantation falls within the uMngeni River catchment, where water demand has already outstripped supply, necessitating the transfer of water from other catchments. According to the ***State-of-the-Rivers Report*** (2002),

afforestation uses up 11% of the available water.

Manager of the Mondi Wetlands Programme, David Lindley, explained that even before Mondi came on board as principal funder in 2000, a constructive partnership had been formed. "Mondi was the first big corporate landowner willing to work with us on wetland rehabilitation and delineation, back in 1996. They then helped us get the broader forestry industry involved in developing a national wetland delineation process, and provided much of the funding for research and consultation."

Delineation is key to wetland protection and rehabilitation, because if the aim is to stay out of wetlands, it's important to be able to define their boundaries. When wetlands have dried out in summer, or where they have been deliberately drained, it is still possible to determine the approximate wetland edge from the surrounding soils, vegetation and topography.

The wetland delineation process has been published as a guideline document by the Department of Water Affairs & Forestry (DWAF), and other sectors – from the sugar industry to property developers – are now using it too.

Sue Matthews

"Delineation is a hot topic right now, and it's opened up something of a wetlands Pandora's Box," says David. "For example, provincial authorities are no longer taking claims in Environmental Impact Assessments that a development is well beyond a wetland at face value, and are requesting consultants to prove the position of the boundary. That has raised questions about who is qualified to conduct wetland delineations, and highlighted the need for an accreditation system."

"Then there's the issue of buffer zones. In urban environments, an extra metre of land could be worth a fortune to a property developer, so buffer zones must be legally defensible. This means they need to be based on good, solid science – which is where the Water Research Commission comes in."

The WRC is to implement a study on behalf of DWAF to develop an approach and methodology for determining appropriate buffer zones for development activities associated with wetlands and watercourses. The study will involve extensive consultation with stakeholders, and the end-product must be scientifically sound but easy to implement.

In the forestry industry, the size of the buffer zone is stipulated in the permit conditions – at least for plantations established post-1972, when the 1968 Forestry Act was amended. Prior to that the industry was unregulated, so existing plantations were exempt from buffer zone restrictions. Yet even they have generally been pulled back from wetland areas, in line with best practices adopted by the industry. It is also a requirement of certification by the Forest Stewardship Council, already obtained for more than 80% of the country's current plantation area of about 1.4 million hectares.

***Left**: During the field trip, participants were shown how soil samples are used in wetland delineation, to identify the wetland edge. Here, journalist Leoni Joubert gets to grips with a soil auger.*

Internationally, the FSC logo allows consumers to identify products originating from well-managed forests.

"All FSC certified plantations in South Africa have adopted the delineation guidelines," says Dr John Scotcher, an independent consultant who acts as the national FSC contact person. "For FSC certification, plantations will either have removed trees from the wetland and buffer zone, or made progress towards this. Typically, if the trees in the buffer zone are five years old and due to be felled only in another decade, they will be allowed to stay until then so that the costs of planting them can be recouped."

Even so, the industry has been hard hit in the pocket by withdrawing from wetlands and buffer zones. Retreating 20 m from the wetland edge represents a loss of 5% of the industry's productive area, which annually contributed 1.4 million tons of timber, worth R800 million per year. Mondi make up about 25% of the industry, so their share of the loss amounts to some R200 million.

It's a sacrifice Mondi is willing to make, but there is concern that the progress made so far may be jeopardised by rapid growth and fragmentation of the industry in the near future. To promote rural development, Government has identified 140 000 ha of land in the Eastern Cape and KwaZulu-Natal suitable for afforestation by small-scale growers, although much of this land is privately owned by farmers or tribal authorities who may not be willing to convert it to plantation.

Obviously, it's much easier to implement industry-wide best practices with a few big landowners, rather than a plethora of small ones. What's more, almost 50% of Mondi land is under claim, and future stakeholders might not have the will or resources to implement wetland rehabilitation – or other conservation measures for that matter, since plantations don't only affect aquatic ecosystems.

Most of South Africa's plantations fall within the grassland biome, some 30%

of which has already been irreversibly transformed. Currently, less than 2% of the biome is formally conserved within nature reserves and national parks, but the South African National Biodiversity Institute's new Grasslands Programme seeks to protect the biome's rich biodiversity by 'mainstreaming' conservation objectives into the forestry, agriculture, urban development and coal mining sectors.

The programme will help plantation growers to manage their land in a way that mitigates biodiversity impacts, and to identify areas of high conservation value for formal protection. It is also working with the Forest Stewardship Council to ensure that grassland biodiversity issues are incorporated into national certification standards, which FSC stipulates must include environmental as well as economic and social aspects.

There's growing recognition throughout the industry that social aspects cannot be neglected, and this is embodied in the Forest Sector Charter - the sector's commitment to transformation – signed in May. While the Charter mainly deals with typical broad-based BEE issues, it also promotes socio-economic development, outlining the provision of services and amenities to the rural poor as a priority. It also suggests that forestry enterprises allow local communities access to non-timber forest products such as firewood, building poles, medicinal plants and edible fruits.

"Mondi is extremely committed to creating a sustainable forestry community," says Viv McMenamin, the company's Forestry and Transformation Director, and newly appointed Chair of Forestry SA, the industry's overarching body. "But it's a long-term journey, and needs to be undertaken in terms of both the environment and people. The forestry industry as a whole needs to become more people-focussed over the next ten years, and help create sustainable livelihoods for our neighbouring communities."

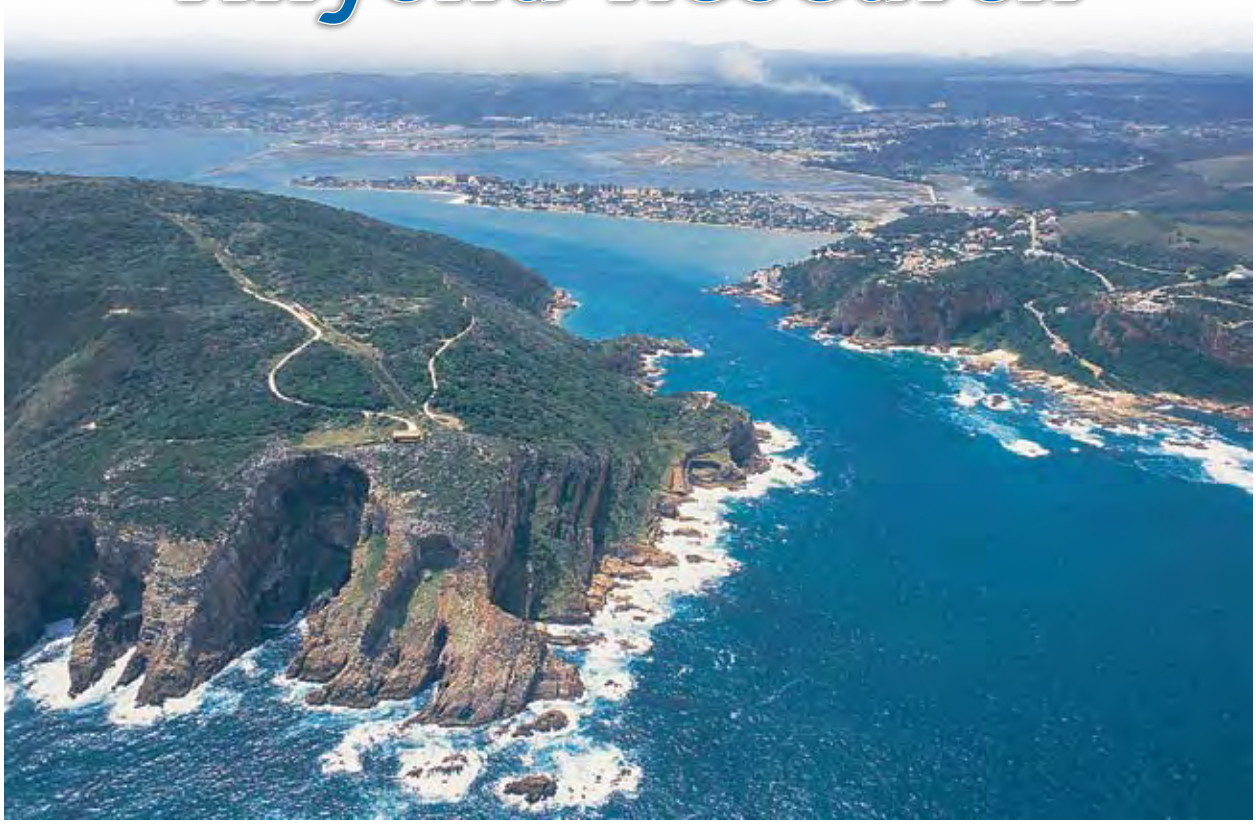
Sue Matthews

David Lindley, Manager of the Mondi Wetlands Programme, explains wetland rehabilitation measures implemented at the Gilboa Plantation.

Sue Matthews

Viv McMenamin, Mondi's Forestry and Transformation Director and Chairperson of Forestry SA, is flanked by (left) Manager of the Mondi Wetlands Programme, David Lindley of WESSA, and (right) Morné du Plessis, CEO of WWF-SA, as she signs the funding agreement to extend Mondi's support of the programme for another five years.

Modern Laboratory Boosts Knysna Research



SA Tourism

The long-term research and monitoring programme in one of South Africa's premier estuaries is settling well into its new field laboratory, providing new impetus to efforts to conserve what is left of the Cape South Coast's estuarine beauty.

The new field laboratory of the Knysna Basin Project, situated in Knysna's industrial area, was officially opened earlier this year by Executive Mayor Eleanore Bouw-Spies. The laboratory, which houses state-of-the-art equipment used in aquatic science, forms a strong base from which the Project can serve its primary objective, which is to improve understanding of the biophysical processes that maintain the Knysna River estuary.

The Knysna Basin Project was established after a need was established for a continuing research and monitoring programme to ensure the sustainable management of the estuarine embayment and other contiguous estuarine systems along the Cape South Coast. The primary responsibility of the Project is to contribute, through research and monitoring, to the ecological health of the estuary.

NURSERY OF THE SEA

The Knysna River estuary has the largest volume of seawater entering during neap and spring tides. It has one of the highest biodiversity levels of any estuary in South Africa, and is extremely energy-productive. Because of its permanently open mouth, Knysna is host to a variable marine fish population and is considered one of the top three most important estuaries for the marine environment in southern Africa.

Small bait fish, such as the estuarine round herring and Cape silverside breed in the estuary, while important line fish such as the spotted grunter, white steenbras, dusky kob and Cape stumpnose use it as a nursery.

Following its establishment in the 1990s and up to 2002, the Knysna Basin Project occupied a field laboratory on Thesen Island from which important studies on the hydrodynamics, chemistry and

biology of benthic organisms were carried out by a variety of research teams. "This was a productive period in the life of the Project," explains Project Director Dr Brian Allanson. "Unfortunately, the press of development on Thesen Island led to the closure of the field laboratory. At the end of 2002, there was no suitable alternative site on which to re-establish the laboratory."

A substantial donation to the Project by Barloworld in 2007 led to a renewed search for a suitable site. "The search for new premises was no easy task – suitable lagoon-side sites had been built over and were beyond the financial resources of the Project," Dr Allanson tells *the Water Wheel*.

A NEW START

In the end, suitable accommodation was found in the Knysna industrial area, and the laboratory is, once again, comfortably housed. Dr Allanson reports that the new laboratory is the base from which Phase 2 of the Project has been launched. "This phase involves a strong system approach towards extending the processes involved in maintaining the health of the estuary while satisfying the resource requirements of a burgeoning population within the basin."

Because of its permanently open mouth, Knysna is host to a variable marine fish population and is considered one of the top three most important estuaries for the marine environment in southern Africa.

The estuary faces a number of threats, the biggest being the town in its immediate basin. Already about a quarter of the Knysna salt marshes (the second-largest in South Africa after Langebaan) has been destroyed by urban development, such as the building of houses, canalisation, land reclamation, hardening of soils, and road cuttings. Other threats include increased water demand and stormwater and wastewater treatment plant effluents that flow into the system via the Ashmead canal.

Knysna Basin Project

The new field laboratory of the Knysna Basin Project situated at 32 Waenhout Street, Industria.

"Each of these factors has a distinctive biophysical nature. While the earlier estuary studies demonstrated the reality of these factors in the life of the estuary, quantitative systems analysis was not their primary objective," explains Dr Allanson. "The influence of these factors has been underlined by the completion of the Intermediate Estuarine Reserve Study by a team of specialists led by Dr Angus Paterson of the South African Environmental Observation Network. The excellent work of this team has emphasised the increasing severity of the impacts that arise from these environmental factors."

The new laboratory has come to the right place, at the right time. Its facilities are available to any research group wishing to expand South Africa's understanding of microtidal estuaries and, through this fundamental approach, provide the essential information required to sensibly manage this unique biological entity.

CONCERNED INTEREST GROUP

While the Knysna Basin Project is a recognised research programme within the Department of Zoology and Entomology at Rhodes University, it is also an association of interested people that was recently established to attract and sustain the interest and direct involvement of the Knysna community. Its constitution was formally accepted at a special general meeting held on 5 August.

The association is now in a position to apply for Public Benefit Body status through the Department of Social Affairs – an important step towards recognition in the wider spheres of government. The project also boasts a new website, www.estuary.co.za. "We look forward to increasing contact and collaboration with the estuarine research community," says Dr Allanson.

SANParks

Anthropogenic impacts are threatening the Knysna River estuary, one of South Africa's premier estuaries.

Corruption Threatens Development and Sustainability – Report

Corruption in the water sector is a root cause and catalyst for the global water crisis that threatens billions of lives and exacerbates environmental degradation, according to the Global Corruption Report 2008: Corruption in the Water Sector, released by Transparency International earlier this year.

The report, the first of its kind to explore the impact and scope of corruption in different segments of the water sector, identifies a range of problems, from petty bribery in water delivery to procurement-related looting of irrigation and hydropower funds; from covering up industrial pollution to manipulation of water management and allocation policies.

"Water is a resource without substitute. It is paramount to our health, our food security, our energy future and our ecosystems. But water corruption plagues water management and use in all these areas," said Transparency International Chair Huguette Labelle.

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The poor, especially women, are affected most by corruption in the water sector.

The water crisis is undeniable and the corruption challenge it faces is urgent. More than a billion people worldwide have no guaranteed access to water and more than two billion are without adequate sanitation, which has devastating consequences for development and poverty reduction.

GLOBAL RESPONSE TO CLIMATE CHANGE THWARTED

"Climate change requires the world to come up with what is likely to be the most far-reaching and complex global governance framework ever devised. Without addressing the corruption risks, especially as they relate to water, such plans stand on shaky ground," said Labelle. The report demonstrates corruption's potential to obstruct effective enforcement of water-sharing pacts and resettlement arrangements, both key to confronting the fallout from climate change.

Irrigated land helps produce 40% of the world's food, but corruption in irrigation is rampant. Addressing this risk is fundamental to increasing food production and tackling the global food crisis. "Massive new investments have been announced worldwide to help counter the food crisis, yet water shortage means food shortage and if corruption in irrigation is not also addressed, these efforts will fall short," explained Labelle.

For the Philippines, which has allocated close to US$1-billion for irrigation and related agricultural improvements, the report presents case evidence of how corruption has hindered the building and performance of irrigation dams. In India, corruption is estimated to add at least 25% to irrigation contracts and the proceeds help maintain a corrupt system of political handouts and compromised oversight. In the end, investment costs rise, systems are rendered inefficient and small farmers are left especially vulnerable to water shortage. In turn, in Mexico, the largest 20% of farmers reap more than 70% of irrigation subsidies.

POOR CARRY THE GREATEST BURDEN

When corruption occurs, the cost of connecting a household to a water network increases by up to 30%, raising the price tag for achieving the Millennium Development Goals for water and sanitation by US$48-billion, according to expert estimates in the report. Corruption in drinking water and sanitation emerges at every point along the water delivery chain; from policy design and budgeting to building, maintaining and operating water networks. It drains investment from the sector, increases prices and decreases water supplies.

Industrialised countries are not immune. Corruption has plagued the tendering of water contracts in cities such as Grenoble, Milan, New Orleans and Atlanta. Likewise, cases of bid-rigging and price-fixing in water infrastructure provision have surfaced in Sweden, while in Chicago water budgets fell victim to misuse for political campaigning.

The report found that in wealthier countries corruption risks are concentrated in the awarding of contracts for building and operating municipal water infrastructure. This market is worth US$210-billion a year in Western Europe, North America and Japan alone.

RISK FOR ENVIRONMENT AND ENERGY SECURITY

Corruption in water resources management undermines the sustainability of water supplies, fuels highly unequal water sharing which can incite political conflict and fosters the degradation of vital ecosystems. In China, for example, corruption has weakened the enforcement of environmental regulations, abetting the pollution of aquifers in 90% of the cities and making over 75% of urban rivers unsuitable for drinking or fishing.

Corruption in hydropower inflates the cost of dams and related projects. It also makes re-settlement more challenging by preying on compensation funds and initiatives meant to aid displaced people.

EXAMPLES OF CORRUPTION IN AFRICA AND ITS REPERCUSSIONS

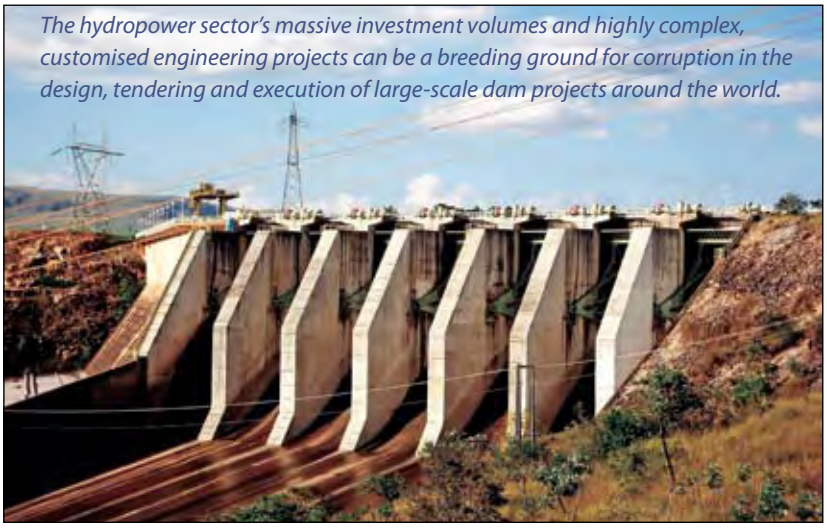
Egypt: Dire water shortages triggered widespread public protect and roadblocks in the summer of 2007. The outcry was fuelled by the perception that corruption had been a major factor in this water crisis.
Kenya: A survey of Nairobi households in 2006 found that 50% considered their bills to be unfair and 66% had experienced water-related corruption in the previous 12 months.
Lesotho: In the multibillion Rand Lesotho Highlands Water Project, the Chief Executive of the project was found guilty of accepting bribes worth millions of Rand from multinational companies vying for contracts.
Malawi: The mapping of new water collection points constructed between 1998 and 2002 found that half of them were in areas that had already reached the recommended coverage and that more equitable distribution could have lifted almost all districts above this threshold. In some communities, the disparity was linked to political affiliations determining the construction and location of water points.
Mauritania: Stand-post attendants who open and close water pipes for public use are known to pay bribes to obtain these important community jobs and pass the costs on to the service users (usually the poor).
Tanzania: A World Bank analysis of the national water budget found that a poor rural citizen received only a fifth of the water subsidy that a rich urban resident garnered. Moreover, up to 41% of all subsidies went to the country's wealthiest 20% of households.
Zimbabwe: Extortion in the repair and maintenance service has been reported. A resident of Harare was told the broken pipe leaking sewage into his house would not be fixed unless he 'dropped a feature' i.e. paid a bribe.

Source: *Global Corruption Report 2008*

TIME FOR ACTION

Corrupt conditions in water persist because their greatest impact is exacted on those with the least chance of redress, disproportionately affecting women, the poor and those with no voice at all: future generations and the environment.

Nonetheless, as the Global Report shows, taking action against corruption in the water sector is both timely and feasible. Key recommendations of the report include:



The hydropower sector's massive investment volumes and highly complex, customised engineering projects can be a breeding ground for corruption in the design, tendering and execution of large-scale dam projects around the world.

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Establish transparency and participation as guiding principles for all aspects of water governance: From transparent budgeting and participatory policy-making to public mapping of water pollution, public audits of projects and access to contract terms and performance reports, transparency and participation strengthen integrity in water governance.

Strengthen regulatory oversight: Government and the public sector continue to play the most prominent role in water governance and should establish effective regulatory oversight, whether for the environment, water and sanitation, agriculture or energy. Institutional reform and capacity building are essential to bring oversight in water up to the standard already achieved in other sectors.

Ensure fair competition and accountable implementation of water projects: All stakeholders have a role to play. Contracts should incorporate anti-corruption measures. Government and contractors can enter into agreements for fair public procurement. Lenders and donors must strengthen anti-bribery provisions in their due diligence requirements.

WATER Kidz

Ready, Steady, Monitor!

On 18 October World Water Monitoring Day (WWMD) will be celebrated in countries all over the globe, including South Africa.

WWMD is an international education and outreach programme, which was initiated by the Water Environment Federation (WEF) and the International Water Association (IWA). The programme builds public awareness and involvement in protecting water resources around the world by engaging ordinary people, and especially school children, to conduct basic monitoring of their local water bodies.

The organisers have made available an easy-to-use kit, which enables everyone, from children to adults, to sample local water bodies for a core set of water quality parameters, including temperature, acidity (pH), clarity (turbidity) and dissolved oxygen. Following the monitoring period (18 September to 18 October) results are collected, analysed and shared with participating communities through the WWMD website (www.worldwatermonitoringday.org). The timeframe for monitoring was selected to foster consistency in monitoring dates across the world.

The coordinators of this special programme hope to expand participation to a million people in 100 countries by 2012. Last year, more than 46 000 people from Argentina to Zimbabwe visited their local streams, rivers, lakes and other water bodies in celebration of WWMD. This represented an increase of 61% over participation in 2006. The organisers hope to attract even more participants this year.

In addition to the core set of water quality parameters, some groups also tested for the presence of certain macroinvertebrates such as dragonflies, mayflies and scuds. Samples were taken in a range of settings – agricultural, commercial, residential and industrial. Some participants acted as individuals, while many took part with schools, universities, civic, environmental and faith-based groups.

Data was reported from 43 countries, with sites in the US accounting for about 63% of the 3 544 monitored worldwide. After the US, Taiwan (444) and Spain (343) led global WWMD efforts in the number of sites monitored.

The Department of Water Affairs & Forestry (DWAF) leads WWMD activities in South Africa. This year, DWAF will engage with selected schools that are participating in the 2020 Vision Programme and equip them with monitoring kits to determine the physical and microbiological quality of their tap water.

This will be done in cooperation with the responsible water service authorities since the municipality will be benefiting by having access to additional water quality information.

On 18 October, groups around the world will come together to monitor the quality of their water resources.

Yuven Gounden

In addition, the department reports that 18 October has also been set up as D-day for water service authorities to have water sampling programmes in place as is required by the Water Services Act. "It is the legislated duty of water service authorities to have sampling programmes in place in order to ensure that the quality of drinking water supplied to the public by means of formal reticulation, complies with the National Standard," DWAF said in a statement.

SOUTH AFRICA'S RIVER HEALTH PROGRAMME

South Africa has had a national programme in place since 1994 to assess the health of its rivers, namely the River Health Programme (RHP). The RHP, which is a collaborative effort between the Department of Water Affairs & Forestry, the Department of Environmental Affairs & Tourism, and the Water Research Commission (WRC), assesses the biological and habitat integrity of rivers. This is done through the evaluation of, among others, fish, aquatic invertebrates and riparian vegetation.

This assessment enables reports on the ecological state of the river system to be produced in an objective and scientifically sound manner. Information from the RHP assists with identification of those areas where unacceptable ecological deterioration is taking place. In addition, this programme reflects the effectiveness of existing river management policies, strategies and actions

Apart from the two national government departments and the WRC, a variety of organisations within each province implement the River Health Programme at a local level. The following state-of-the-river reports have been completed to date, and can be downloaded from the RHP website (www.csir.co.za/rhp): Gouritz water management area; Mokolo River; Olifants, Doring and Sandveld rivers; Greater Cape Town rivers; Crocodile (West) Marico water management area; Buffalo River System; Berg River System, Free State region; Diep, Hout Bay, Lourens and Palmiet river system; Umgeni River, Letaba and Luvuvhu rivers, and Crocodile Sabie-Sand & Olifants rivers.

WATER QUALITY PARAMETERS

Dissolved oxygen: Aquatic organisms such as zooplankton, invertebrates and fish require sufficient levels of dissolved oxygen (DO) to survive. The amount of DO in the water is a factor in determining the species and abundance of organisms that can live in a river, stream or estuary.

Temperature: Temperature is a critical factor in determining where aquatic organisms live and how well they thrive there. Growth rates of aquatic plants and cold-blooded animals generally increase with temperature, up to the thermal optimum. Shifts in temperature cause variation in, for example, phytoplankton abundance and species composition. Temperature also affects the solubility of oxygen in the water, which is critical for the survival of aquatic organisms. As water temperature increases, the solubility of oxygen decreases.

Acidity (pH): Solutions with a pH less than 7 are acidic, and those with pH greater than 7 are basic (alkaline). Knowledge of pH is important because most aquatic organisms are adapted to live in pHs between 5.0 and 9.0.

Turbidity: Turbidity is a measure of the ability for light to transmit down through the water column. As suspended solids increase in the water, the amount of light travelling through the water column is reduced. This can influence the populations of organisms that are directly dependent upon light (phytoplankton and aquatic plants) and those, in turn that are dependent upon them as a food source. Suspended solids include particles of algae, sediment, debris or solid waste. Turbidity affects fish and other aquatic life by: a) limiting photosynthetic processes and increasing respiration, oxygen use and the amount of carbon dioxide produced; b) clogging of fish gills and feeding apparatus of bottom dwelling animals by suspended particles; and/or obscuring vision of fish as they hunt food and smothering bottom-dwelling animals.

Workshop Explores the Power of Water in Africa

The Academy of Science of South Africa (ASSAf) and the Water Research Commission hosted a successful African Hydrology and Hydropower Training Workshop in Pretoria. The workshop investigated the use of hydropower as an alternative energy source on the African continent. To date, the African continent has used less than 10% of its potential to generate hydropower, thus signifying great potential for the future development and use of this energy source. The workshop evolved from the need to increase the utilisation of Africa's favourable hydrology and climate to generate sustainable and reliable power on the continent. Participants deliberated a number of topical issues on the importance of hydropower amidst a global and regional move towards diversified and renewable energy technology solutions, including regional hydrology, climate change and energy security, established hydropower schemes, and potential new schemes in Africa, among others.

Left and below: *Workshop participants were treated to a site visit to the new R80-million hydropower project currently under construction outside Bethlehem, in the Free State, which is expected to be commissioned before the end of the year.*

Left: *Workshop participants visited the Lesotho Highlands Water Project Ash River Outfall, situated 8 km outside Clarens, in the Free State.*
Above: *Workshop participants included specialists from ten African countries, representing their respective government, and various energy sector and academic institutions.*

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National Water Resources
Department of Water Affairs and Forestry, South Africa

Qedani Dorothy Mahlangu
MEC: Local Government
Gauteng Provincial Government, South Africa

Fazel Sherrif
Executive Director: Water and Sanitation
City of Tshwane Metropolitan Municipality, South Africa

Gerald Dumas
Managing Director
Johannesburg Water, South Africa

Nolene Morris
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Bloem Water, South Africa

Alex Kaaya
Chief Executive Officer
Dar es Salaam Water & Sewerage, Tanzania

Dr William Muhairwe
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National Water & Sewerage Corporation, Uganda

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