Civil Engineering

Siviele Ingenieurswese

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SAISI SAICE

ON THE COVER

The R1,6 billion Berg Water Project near Franschhoek in the Western Cape will provide almost 20 % more water to the integrated Western Cape water system by 2007. Here is a view of the Berg River upstream from where the dam is being constructed (see article on page 15)

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MAIN FEATURE

WATER ENGINEERING

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Gauteng traffic
a recipe for disaster!

THE TOTAL ABSENCE of any information to, or communication with, Gauteng commuters about their future is becoming a matter of national concern. After all, Gauteng is the so-called engine of South Africa and in turn we are the engine of Africa. But we are heading for disaster in terms of transportation of people to and from their places of work. We are probably squandering BILLIONS of rand on wasted and lost time, fuel and wear and tear on vehicles alone. Where is the problem? Nobody seems to have an answer and one hears only vague nonsensical answers, including 'no funds, no capacity, no staff, no decision-making … no nothing …'.

The interesting – or maybe it should be disturbing – fact is that all of us and them, whoever they are, are in the same boat. Or are we drifting around in some kind of paralysed stupor and strong belief that somebody else will do something sometime about the impending gridlock that looms over the City of Gold and its neighbours?

So let me ask some questions and make some observations.

Where are you?

Week mornings from 06h30 to 08h30

- When it takes one-and-a-half hours to travel from Roodepoort to Midrand – a total of 34 kilometres?
- When it rains and it takes three hours to travel that same distance?
- When a mere bumper bashing attracts seven emergency vehicles with nobody to rescue and the Western Bypass is stationary for hours?

Late afternoons from 16h00 to 19h00

- When it takes at least one hour to get from Midrand to Roodepoort if one leaves between 17:00 and 18:00? By the way, forget about how long it takes to get to Soweto!
- When the taxis now use the emergency lane and overtake on the left – one after the other, on many freeways? And when the ordinary motorist now follows that example, since that is becoming a viable option for getting home?
- When the Metro Police (Police … nogal!) switch on their flashing lights and use the emergency lane to go … where? No, no, not an emergency, but HOME!!

And more questions than answers …

- Why do we persist in calling our clogged roads by esoteric names such as 'freeway', 'by-pass' and 'highway'?
- Why do we have to go to Europe for efficient travel by bus, train, light rail and tram?
- Why do I hear some of my colleagues talking as if they were blaming the motorist and the commuter for the current chaos?
- Do we think that total lawlessness is overtaking the streets and roads because the public are just being difficult, like to take chances, or are just plain 'ongehoorsaam' or un-cooperative?

Let me try to understand the situation: Are you …

- Still asleep when most of us have to get to work?
- In an office in Pretoria-Tshwane and living comfortably in a plush nearby suburb?
- In an academic heaven somewhere, philosophising about non-existent mass transit and using arguments such as: 'Our unsophisticated public will not be able to handle a left turn on red.' My, my, they are sophisticated enough to look round for the Metro Police and then overtake in emergency lanes, jump red lights during the night, and creep around corners. And by the way, they are sophisticated enough to drive cars worth anything from zero to R750 000.
- Pulling your hair out – hence bald transportation engineers such as John Sampson?
- Too busy talking on your car phone to notice what is happening outside that steel, glass and plastic cocoon?
- Escorted by unmarked cars with sirens and flashing lights that push everybody else aside?
- Blind and deaf?
- Retired and living in Knysna and don't care anymore, relieved of the terrible situation in Gauteng. Oh, sorry. I used the wrong example … especially if you want to travel through that town in December and experience the results of non-decision-making forces that cause the through (???) traffic to come to a halt for hours and hours and kilometres?
- Do not own a car, do not travel by minibus taxi, do not go to work?
- Arrogant and not in touch with your fellow human beings and should be recycled as a faulty traffic light and then perhaps will be worth something in terms of being an observer of fatal accidents and near misses?

Are these harsh comments? Of course! I voiced my opinions and a number of possible solutions last year. So far I have heard a whimper or two, support from some, an arrogant remark or two from others, but mostly deathly silence prevails.

We are implementing the first round of the SMART Award this year and I have to wonder whether we will have to 'manufacture' entries … or push and shove and pull to get submissions for sustainable and innovative solutions for our transportation woes. And NO, 'tolling' Gauteng will not work without putting alternatives in place first. That would be the bell tolling for the final funeral of productivity, mobility and getting to work on time sometimes, somehow. Penalising has never worked … there must be a carrot in front of the stick. A new door must be open before you close the first one.

So? I am dumbfounded! Am I really alone in this crusade, a bit like Don Quixote trying to wield the mighty pen against the mighty engineer and his or her decision-maker employers?

We have to wake up … magical 2010 is a mere 54 months away. □

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PART 1

The Orange River

From dream to reality

The Orange River rises in the high mountains of Lesotho. After a long journey it eventually flows through the inhospitable Richtersveld and into the Atlantic Ocean. For more than 75 years civil engineers struggled to devise plans for the large-scale development of the river. This is their story – starting with the first dreams in 1903 through to the announcement of the final plans in 1962. The next article will describe the fulfilment of their dreams, ending with the completion of the project in 1978

THE EARLY EXPLORERS

Early attempts to reach the Orange River

The early Dutch settlers heard about the Grootte River from the local people. In 1659 Van Riebeeck despatched a party northwards. They discovered the Great Berg and Olifants rivers. In 1681 Van der Stel sent a party under Olaf Bergh, who failed to reach it. In 1685 Van der Stel led a large expedition himself. They found copper ore deposits near Springbok before having to turn back.

In 1760 Jacobus Coetse crossed the river at Goodhouse (from the Namaqua word 'Gudaos', meaning sheep path) and carried on to Warmbad in southern Namibia.

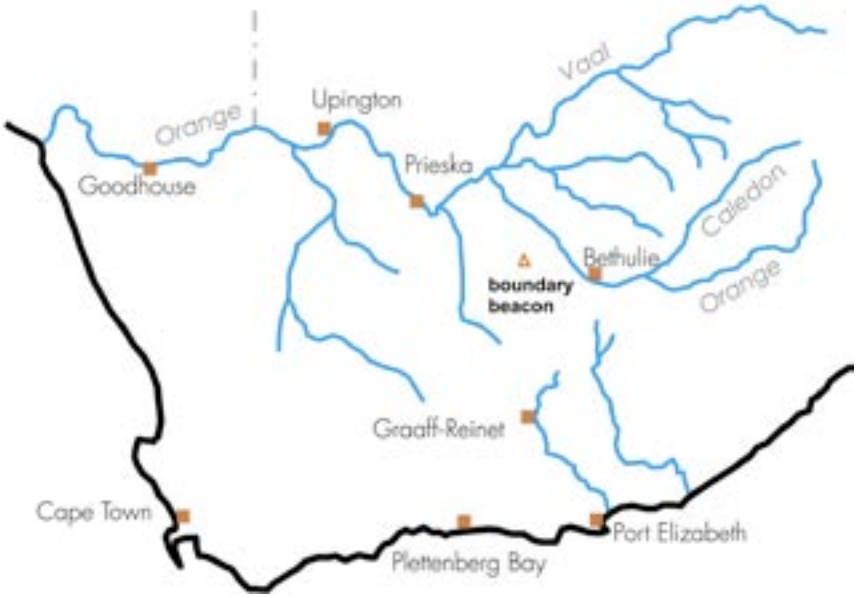
Enter Colonel Gordon

Although of Scots extraction, Robert Jacob Gordon was born in Gelderland, Holland, in 1743. His grandfather was mayor of Skiedan, so that the Gordon family must have been established in Holland for many years before Robert's birth. Robert's father rose to the rank of major general in the Scots Brigade of the Dutch Army and Robert obtained a commission in the same unit. During a period of long leave in 1773, Gordon visited South Africa. He travelled extensively inland and took such a liking to the country that he was anxious to return.

In June 1777 Gordon, now 34 years old, returned to the Cape as a captain in the garrison forces. In October he set out from Cape Town, taking with him the young English plant collector William Paterson. After travelling through Swellendam into the Little Karoo, Paterson was taken ill and had to return home. Gordon, however, continued. He crossed the Sneeuberge near Graaff-Reinet and finally reached the Orange River near Bethulie on 23 December 1777 (see map).

Gordon was accompanied by his draftsman/artist, Johannes Schumacher. Schumacher sketched a panorama of the exit from the poort close to the site of the present rail and road bridge across the dam near Bethulie. They followed the river eastwards until they reached the Caledon River confluence, which Schumacher also sketched. Gordon named the main river downstream of the confluence the Orange River after the House of Orange. He named the main river upstream of the confluence the Prince William V River and the tributary the Princess Wilhelmiena River, after Prince William's wife. However, he must have kept the discovery of the river to himself when he returned to Cape Town, where he arrived back in March 1778.

Project



Governor van Plettenberg

Later that year Gordon accompanied Governor van Plettenberg, who planted a beacon near the Seacow River to mark the northernmost boundary of the frontier. Although this was further to the west than the point where Gordon discovered the Orange River, it must have been obvious to Gordon that the party had crossed the watershed dividing the south-flowing tributaries and the north-flowing Seacow River, and also that the Orange River could not be far away (less than 50 km, as we now know). Why did he not lead the governor, who intended planting a boundary beacon, to the more suitable Orange River? Apparently he feared that the governor would name the river after himself. Gordon and the governor returned to the Cape by different routes. On his way back the governor called at Bahia Formosa and changed its name to Plettenberg Bay.

Hendrik Jacob Wikar

In 1778 Wikar deserted the Dutch East India Company and travelled northwards. He reached the Orange River at Goodhouse, where he settled. Towards the end of 1778 he set off on a 400 km long journey eastwards along the Orange River, turning back about 100 km short of the present town of Prieska. Paterson arrived at Goodhouse soon after Wikar left and so he missed him. Paterson returned to Cape Town. In April 1779 Wikar sent a letter to the governor asking for a pardon. He received a favourable reply and set off for Cape Town in June.

Gordon returns to the Orange River

In 1779 Gordon and Paterson journeyed northwards once more, meeting the returning Wikar at Kamiesberg. Gordon and Paterson veered to the northwest and followed the coast until they reached the mouth of the Orange River on 17 August 1779. They launched a small boat on the river, raised the Dutch flag, and named the river after the house of Orange for the second time. On his map Gordon identified the name of the river as the 'Orange River or Garieb'. They retraced their steps to Kamiesberg. Gordon turned northwards to Goodhouse while Paterson returned to Cape Town. From Goodhouse Gordon followed the route eastwards along the course of the Orange River that Wikar had taken the previous year and, like Wikar, he turned back just short of the present Prieska. Gordon noted that the river had the same size as the river at Bethulie, and had the same general east–west direction. He was certain that this was the same river.

Gordon was promoted to command the Dutch garrison in 1780. In 1795 Gordon had the unpleasant task of surrendering the Cape to the British. Some of his contemporaries accused him of treason, but apart from his name Gordon had no connection with Britain. The life of one of South Africa's greatest 18th-century explorers ended tragically when he committed suicide.

South Africa also owes its flocks of Merino sheep to Gordon. He saw these strong-wooled sheep in the royal stud in Spain and managed to obtain a ram and some ewes which he sent to the Cape to found South Africa's wool industry.

The scramble for Africa

In the 1830s the Voortrekkers crossed the Orange River and established the Transvaal and Free State republics. There was no irrigation potential along this section of the river. Missionaries, hunters and explorers followed a route from Kuruman northwards to central Africa to the west of the two Boer republics. This route became known as the Missionary Road. It crossed the Zambezi River into Zambia at Kazangula at the

From letf to right:
Ancient paleoflood deposits along the Orange River
Barren area near Goodhouse
The Orange River does not have a wide, fertile flood plain

confluence of the Chobe River where the boundaries of Namibia, Botswana, Zambia and Zimbabwe meet at a common point.

The Portuguese were the first European colonisers. They established themselves in Angola on the west coast and Mozambique on the east coast. Jesuit missionaries were established in the vicinity of the Zambezi River. Livingstone was aware of this, but did not make contact with them so that he could preserve his reputation of being the first European explorer in this region. The German spheres of influence were in German South-West Africa and Tanganyika. Count Caprivi established the Caprivi Strip in an attempt to link them. The British were interested in the region Botswana–Zimbabwe–Zambia. This precipitated the 1890 Anglo-German treaty where these two countries agreed to the boundaries defining their spheres of interest.

One of the common Anglo-German boundaries was that along the Orange River. The British discouraged the development by the Germans in this region by denying them the use of water from the Orange River. The relevant portion of the comprehensive 1890 Anglo-German treaty was as follows:

In South West Africa the sphere in which the exercise of the influence is reserved to Germany is bounded to the south by a line commencing at the mouth of the Orange River, and ascending the north bank to the intersection by the 20th degree of east longitude.

This is an onerous provision and was the subject of a long-standing diplomatic dispute between Germany and Britain that extended to the two successor countries, Namibia and South Africa. In 1991 agreement was reached by the government of the independent Republic of Namibia and the government of South Africa, fixing the boundary line as the middle of the Orange River in accordance with international legal practice. A technical team was established with the object of demarcating the boundary line. Notwithstanding this agreement, in November 2000 the South African government made it known that the country's border along the Orange River was not open to discussion and stated that as far as the South African government was concerned, the matter had been laid to rest. This left the entire river, with substantial water, riverine mineral rights and grazing rights between the north bank and the river channel, within South Africa's jurisdiction. The offshore border is also affected since its position depends on the location of the border at the river mouth. This in turn has an impact on lucrative offshore diamond mining and fishing rights, and those for oil and gas exploration.

The future development of the Orange River along the common boundary will pose a number of challenges to the present and future generations of civil engineers from the two countries. For more details on the dispute read Lazarus Hangula's book *The international boundary of Namibia* published by Gamsberg Macmillan in 1993. A R Willcox provides an interesting account of Gordon's travels and other historical material in his book *Great River – the story of the Orange River* published by Drakensberg Publications in 1986.

WATER CRISES IN THE GREAT FISH AND SUNDAYS RIVER VALLEYS

The need arises

In March 1925 the Middleton Surplus Lands Committee issued a booklet urging settlers to buy land along the Great Fish River. 'SURPLUS LAND OFFERED TO SETTLERS' it said, and quoted figures to show that 'a married man can live quite comfortably for less than £8 per month including wages on the keep of a house servant'. The cost of building a five-roomed house was £250 and a local hotel had special terms for prospective settlers – 8/6d per day!

In 1948 the publicity committee of the Great Fish River Irrigation Board issued a booklet predicting disaster in the valley if the Orange-Fish diversion project was not built soon. What lies behind the story of promise turned to tragedy in the short space of 20 years?

To understand the problem we must go back to 1877, when there is the first record of irrigation water being pumped out of the Great Fish River. In subsequent years the individual owners continued to develop their private schemes, but in 1909 the first irrigation district was proclaimed. By 1917 there were 12 irrigation board schemes in existence, but these all relied on flood diversion. The floods were erratic and the irrigators continually agitated for the construction of the storage dams to stabilise the flow in the river.

In 1919, as a result of this agitation, Parliament voted £720 000 for the construction of two dams, namely Grassridge Dam on the Great Brak River to serve the upper Great Fish River valley and Lake Arthur on the Tarka River to serve the lower portions of the valley. Construction commenced late in 1920 and both dams were completed by the end of 1925.

The history of irrigation in the Sunday's River valley is similar to that of the Great Fish River valley, except that the start was made later and on a larger scale by private companies of which there were four by 1913. Lake Mentz Dam was completed in 1922 and van Ryneveld's Pass Dam in 1926.

Irrigators who had hoped that the construction of the dams would effectively stabilise the flow in the rivers and bring a period of continued prosperity were soon to be disillusioned. At the time the dams were built, they were warned that the runoff from the catchments would be inadequate for the proper irrigation of the scheduled areas – a prediction which proved all too true.

The area of land scheduled under Lake Mentz had to be reduced drastically from 17 000 ha to 9000 ha while the scheduled area in the Great Fish River valley was reduced from 22 000 ha to 18 000 ha. To make matters worse, overgrazing resulted in serious soil erosion in the catchment areas of the dams and large volumes of sediment were soon being carried downstream by the flood waters. Within a few years, dams, diversion weirs and irrigation canals had their capacities drastically reduced by sediment deposits. The depression years of the early 1930s and the crippling drought of 1933 brought irrigators to near bankruptcy. By 1934 all outstanding monies owed by the irrigators to the state, totalling £2 350 000, had to be written off.

In his 1928/29 annual report to Parliament, the Director of Irrigation published his address at the Irrigation Congress in Graaff-Reinet on 12 October 1928. The subject was 'Possibilities of irrigation schemes from the Orange River'. His views were pessimistic.

My chief and great regret in presenting this summary is that I cannot put forward for the Orange (as apart from the Vaal), a single scheme of any magnitude and of such merit as to justify the great optimism which at present prevails. Notwithstanding the disappointments of the past, the Department, so far as lies within its power, will continue to search for a big scheme, and to appreciate any suggestions from any source which might lead to a promising line of reconnaissance.

Van Ryneveld's Pass Dam rarely spilled

He provided details of the many projects that his department had investigated, including the possibility of diverting the Orange River to the valleys of the rivers

From top to bottom: Construction of Lake Mentz Dam, Lake Mentz after raising, Lake Mentz empty despite raising

running southwards such as the Sundays River. He reported that a tunnel about 80 km long from a point on the Orange River between Norvalspont and Bethulie would carry water to the Brak River tributary of the Great Fish River. To reach the Sundays River would be an even more difficult proposition.

Orange River diversion concept

The Orange River has its source in the Drakensberg mountains of northern Lesotho. After leaving Lesotho the river flows south-westwards towards Venterstad and then it swings away in a more north-westerly direction. By a fortune of geography, the southernmost reach of the river coincides with the shortest distance between it and the headwaters of the Great Fish River to the south. Furthermore, the Orange River has a flat gradient and at Venterstad it is still 1 200 m above sea level. This combination of circumstances made the diversion of water from the Orange River into the steep but low-lying headwaters of the Great Fish River, through an 82 km long tunnel, an attractive proposition to the engineers and irrigators in the late 1920s.

However, this was an imaginative concept to propose in those days, because even by today's standards this civil engineering feat is in world class and the tunnel is far longer than any continuous tunnel elsewhere in the world. However, it was not the engineering problems but the financial ones which prevented the plans from being put into practice.

Temporary relief

While it was realised that the diversion of the Orange River would provide the only permanent solution, temporary relief had to be provided until it could eventually be implemented. Energetic anti-soil erosion measures were taken in the catchment areas, but not only would these take many years to become effective, they would also reduce the runoff even further. Dams built on rivers having high sediment loads become wasting assets as soon as they are built. To protect the valleys for the use of future generations, it was essential to make use of the few remaining storage sites only when driven thereto by necessity. Thus it was that Lake Arthur was raised in 1939 and 1945, Grassridge Dam in 1947, and Lake Mentz in 1936 and 1951.

However, by 1950 Lake Arthur's capacity had been so reduced by sediment deposition that it was no longer effective as a storage dam. The new Commandodrift Dam was built at the confluence of the Tarka and the Vlekpoort rivers some 24 km upstream. At the same time a system of tunnels and open canals was built from Lake Arthur to serve higher portions of the Great Fish River valley and so relieve the load on Grassridge Dam.

In 1942 the Department of Irrigation predicted that all possible storage sites in the two valleys would be fully exploited within the following 50 years, and thereafter the schemes would have to revert back to flood irrigation.

By 1947 the preliminary planning had reached an advanced stage and irrigators in both valleys were jubilant when the Director of Irrigation's report on the proposed Orange-Fish-Sundays diversion project was published. The proposal was to build a barrage across the Orange River on the farm Doornpoort some 10 km upstream of Venterstad. From the barrage the water was to have been conveyed along a canal to desilting works on the eastern flanks of the Brakspruit valley. These would remove all the rolling sediment and part of the suspended sediment before the water entered the tunnel. On emerging from the tunnel the water was to have been fed into canals, further tunnels, and existing river channels into Grassridge Dam, Van Ryneveld's Pass Dam and Lake Mentz.

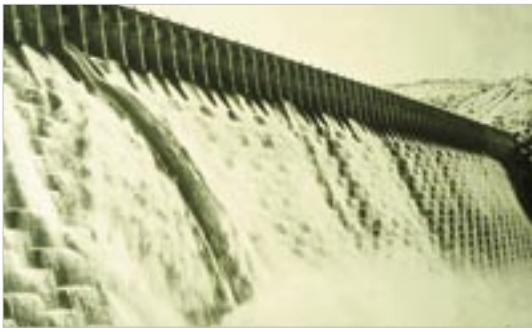
The proposed tunnel capacity was 57 m^3/s but the first 17 m^3/s of any flow in the Orange River would have to be allowed to pass through the barrage to the irrigation schemes lower down the Orange River. The sole purpose of a project was the diversion of water out of the Orange River into the headwaters of the Great Fish and Sundays rivers. No storage dams on the Orange River were proposed, thus prolonging the potential lives of storage basins and giving the anti-soil erosion measures a chance of reducing the quantity of sediment entering the river.

The total estimated cost of the project was R35 million, of which the estimated cost of the tunnel alone was R20 million. The proposal was almost brought to fruition, but once again financial difficulties were encountered. Sterling was devalued, and the project went onto the shelf once more.

The irrigators reacted strongly:

The Directors' report to the Minister on the Orange-Fish-Sundays diversion project is a masterly statement of a highly imaginative and daring conception. It should be read in full by every publicist, economist, editor, politician, in fact by every man and woman who think – and talk – about things South African.

If there is so little faith in the financial stability of the Union of South Africa that it is considered unsafe to embark on so expensive an undertaking until times improve; if there is so little faith in the degree of progress that this country has reached that it is thought too ambitious yet to consider so highly civilised a form of agriculture, let the word go forth. The Great Fish River irrigators accepted the decision with regret but with a resignation. Resignation, indeed, will be the operative word for not many of them will stay to suffer the 50 year long death agony the Director foresees.



Top: Lake Arthur Dam as built
Bottom: Lake Arthur spilling after first raising

Only the diversion of the Orange River into the valleys would save the Cape Midlands from eventual bankruptcy and ruin. It was only in 1962 that the final approval of the project was announced.

To be continued in our next issue

WATER NEWS FROM SHANDS

Internal strategic perspectives for Eastern and Western Cape

The Theewaterskloof Dam in the Riviersonderend River provides urban water supplies to the Greater Cape Town area and urban and agricultural water for use in the Berg River catchment and demand centres along the West Coast. The Riviersonderend River is the main tributary of the Breede River

Vineyards in the Slanghoek Valley, to the north-west of Worcester. Irrigated agriculture is responsible for a large portion of the Breede region's gross geographic product and is a major user of water

IN ORDER TO ACHIEVE more inclusive water resource management which would address the inequities of the past, the National Water Act (36 of 1998) initiated an appropriate process. It provided for the establishment of 19 catchment management agencies that would each manage water-related matters within a defined area, called a water management area, in close cooperation with its water users.

It was recognised that it would take several years to implement this ambitious plan and that the Department of Water Affairs and Forestry (DWAF) would need to document its existing management approach and understanding with regard to a specific perspective on the management of water-related matters. This could be used to guide interim catchment management agencies until they would be able to develop their own catchment management strategies. In early 2002 a programme of drafting a series of internal strategic perspectives (ISPs) for each water management area was initiated.

Ninham Shand, together with Tlou & Matji, Jakoet & Associates, FST, and Umvoto Africa, were appointed to capture relevant history, situations, issues, problems, approaches and projects (existing and planned) relating to the management of specific water resources, and to assist DWAF in developing appropriate strategies to manage water at a water management area level. Physical and manmade characteristics of the ISP areas were documented, along with the water resources perspective of the ISP areas and sub-areas, as well as a range of strategies, grouped within ten strategic areas. Each strategy sketches the specific water situation and recommends a strategic approach and implementation plan.

The ISPs are a major step forward for water management in South Africa, and are widely appreciated and accepted within DWAF and water community.

The ISP areas addressed by the Ninham Shand team are the Berg, Gouritz, Breede and Olifants/Doorn water management areas in the Western Cape, the Fish to Tsitsikamma water management area (split into the Tsitsikamma, Coega and Fish-Sundays ISPs) and the Mzimvubu to Keiskamma water management area (split into the Amatole-Kei and Mbashe-Mzimvubu ISPs) in the Eastern Cape.

Hex river hydrology model

THE HEXVALLEI, Drie Rivieren and Worcester-East Irrigation Boards have appointed Ninham Shand to implement a hydrological model to manage the flows of the Hex River.

Highly intensive irrigation along the Hex River and its tributaries in the De Doorns-Worcester area has made the allocation of water between the irrigators extremely difficult. By means of a computerised hydrology model it will be possible to determine the flows associated with an agreed level of water use at selected points in the system. Recorded flows at indicator sites will be used to account for the effect of the prevailing climate on target flows. Differences between target flows and actual flows will be reconciled on a monthly basis. Deficits will be corrected by means of additional releases from upstream dam(s). The proposed solution will assist the water users of the Hex River Valley to distribute the scarce water resources of the region equitably.

It is envisaged that the model, which is being implemented, will form the basis for an agreement between the different parties. Currently, the lack of agreement prevents further development in the area. The construction of the Osplaas Dam is one such development.

Sesbek diversion in the Hex River

Kokstad drought relief

THE TOWN OF KOKSTAD in southern KwaZulu-Natal has suffered below-average rainfall since 2001. By the end of 2003 the situation was very serious, as the capacity of the town's sole source of water, the Crystal Springs Dam, was down to 10 %. An application for drought relief funding, drafted by Ninham Shand in conjunction with officials from the Greater Kokstad Municipality and Sisonke District Municipality, was submitted to DWAF and a sum of R4 million was granted early in 2004 to the Water Services Authority (Sisonke District Municipality) for Kokstad.

A drought relief task team was formed and Ninham Shand Pietermaritzburg was appointed to manage the technical aspects of implementing a multi-faceted programme to both reduce water consumption and develop additional sources of water.

The main source of relief centred on the completion and commissioning of a new pumping scheme. This had been initiated early in 2003 as part of a larger bulk water supply upgrading project, whereby water is abstracted from the Mzintlava River and pumped 5 km to the town's waterworks.

With the unregulated river rapidly drying up, it was decided to construct a 6 m high rollcrete dam on the river upstream of the new pump station so that runoff from any late seasonal rains could be captured and then released down the river for the town's use. With a catchment area of 860 km^2, even a small rainfall event would provide a significant volume of water.

The rollcrete option was adopted as the work could be fast-tracked and water could be captured and stored from the early stages of construction.

Construction started in May 2004 and despite a very tight budget, sub-zero overnight temperatures, two snowstorms, and a downpour that breached the cofferdam and overtopped the almost-complete rollcrete wall, the dam was completed in September 2004.

By the time the river pumping scheme was commissioned in May 2004, the Crystal Springs Dam was down to only two weeks' supply of water. With the new 400 000 m^3 rollcrete dam in place, there has been sufficient captured water to release down the river for pumping to the waterworks, thereby allowing the older dam to slowly recover and fill up to 55 % capacity at the end of February 2005.

Al-Ezzel power station cooling water system

Al-Essel site of intake structure at high tide

THE AL-EZZEL POWER STATION is under construction in Bahrain. The power station is being constructed for the Al-Ezzel Power Company by Siemens, the main contractor. Siemens have subcontracted the construction of the civil engineering components of the cooling water system to NASS, a very experienced local contractor, who have appointed Murray and Roberts Engineering Solutions, assisted by Ninham Shand and Chris Michau, to undertake the detailed design.

The cooling water system for the 954 MW Al-Ezzel power station will abstract a sea water flow of 29,2 m^3/s from one side of the reclaimed peninsula and discharge it on the other side. The reclaimed site comprises coarse imported sea sand with occasional lenses of soft clay overlying weathered in-situ rock at a depth of about 8 m.

The intakes of the cooling water system will comprise the sea water intake structure and two 2 800 mm GRP pipes, buried at a depth of 6–8 m, and discharging into the cooling water pump station. The reinforced concrete pump station will house four sets of screens and pumps and will be 11 m deep x 25 m wide x 33 m long. Each pump set will discharge into one of four 1 800 mm GRP pressure pipes, which discharge into the condensers, from which another four 1 800 mm GRP pipes transport the water to the reinforced concrete seal pit. The flow from the seal pit will be conveyed to the outlet structure in the sea by a 1 600 m long twin-box reinforced concrete culvert, each barrel being 3,1 m x 3,1 m.

Southern high-confidence reserve determination studies

THE RESOURCE-DIRECTED Measures Directorate of DWAF is tasked with the responsibility of ensuring that the reserve requirements for the ecology and basic human use are determined before license applications are processed.

The Olifants/Doring and the Kromme/Seekoei rivers are water-stressed catchments which were selected for high-confidence reserve determinations. DWAF has appointed Ninham Shand to manage these two technical studies on their behalf. Ninham Shand is well placed to undertake this work, as it requires technical knowledge of water resource management, reserve determination methodologies and the ecology, strong project management skills as well as knowledge of the DWAF procurement processes and administration.

The primary purpose of the study is to assist DWAF with the coordination of all the activities required to achieve the objectives of the technical reserve determination studies. A secondary purpose is the transfer of project management skills to historically disadvantaged individuals, or firms, by training them in the day-to-day management and coordination of activities that will be undertaken by the project management and technical teams. □

Major new sewage pumpstation near Ballito

STEMELE BOSCH AFRICA (SBA), part of the B&A Group, have been appointed by Siza Water Company to undertake the engineering services for a major new sewage pumpstation and pipeline to provide efficient removal of sewage at the Simbithi Eco-Estate, currently under construction near Ballito, north of Durban.

'These services include the engineering design and tender, working drawings and construction and installation stages for the civils, mechanical, electrical and instrumentation components of the project,' says SBA's Morrell Rosseau. 'This new sewage pumpstation, rising main and trunk sewer will serve phases 1 to 4 of the Simbithi Eco-Estate development as well as a further 730 units in the catchment area, and flows from the Martinique and Santorini pumpstations. Odour control chambers have been installed in the pumpstation and pumping line to efficiently eliminate gases emitted from sewage.'

Sewage will be pumped from the new Simbithi pumpstation to the existing Fraser's wastewater treatment works, which is also currently being augmented from its current 6 Mℓ/d capacity to 12 Mℓ/d capacity, with SBA as the engineers.

Construction of the pumpstation, which is nearing completion, commenced in July 2004 and is due for commissioning in May 2005.

Disposal pipeline for northern KwaZulu-Natal

KNIGHT PIÉSOLD CONSULTING invited Stemele Bosch Africa to form a joint venture in submitting a successful bid for the design and construction monitoring phase of the new Empangeni to Richards Bay Industrial Effluent disposal pipeline. The primary objective of the pipeline is to dispose of the effluent generated at Ticor South Africa's central processing complex in Empangeni via the existing Mhlathuze Water marine outfall system in Richards Bay.

The project to extend the effluent disposal system, which is owned and operated by Mhlathuze Water, began in September 2002 when the Knight Piésold Stemele Bosch Africa Joint Venture conducted a study for Ticor which concluded that the Mhlathuze wastewater disposal system was the most appropriate and cost-effective system to tap into, at an estimated cost of R21,8 million for the 16,5 km long pipeline.

'The sewage and industrial wastewater from the central processing complex of the Ticor factory is currently disposed of via the Empangeni sewage treatment works, but it has now become necessary to find an alternative means of disposal for the industrial effluent component,' says Morrell Rosseau, Stemele Bosch Africa director and a member of the project team. 'This project has some interesting design and construction challenges, because, apart from the undulating topography, timber plantations and low-lying swampy areas adjacent to Lake Nsezi through which the wastewater is pumped, important issues like safety and social and environmental considerations also had to be taken into account. The team had to deal with possible odour problems, proximity to existing services, and contamination in the unlikely event of a spillage.'

The project comprises a 250 mm diameter rising main some 4,5 km long between the Ticor factory and a break pressure tank from where it discharges into a 350 mm gravity main 12,0 km long to the head of the Mhlathuze Water marine wastewater disposal pipeline adjacent to Mondi in Richards Bay. The pipelines are sized to cater for the proposed future installation of two additional smelters at the Ticor plant and future industrial development in the Empangeni area.

Along the route of the pipelines, seven road and rail crossings are necessary and these will be facilitated via sub-surface pipe jacking. A total of 33 air valves and 10 scour valves will be installed along the pipe route.

The Knight Piésold and Stemele Bosch Africa consulting practices are both well established companies with excellent transformation credentials and representation in most of the major centres in South Africa as well as having international links.

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John Banyard, FREng FICE
5th Brunel International Lecture

Water for the world
Why is it so difficult?

In the 5th Brunel International Lecture, delivered at Rand Water, John Banyard of the UK Institution of Civil Engineers attempted to set out the answer to the question 'Water for the world – why is it so difficult?' In brief, he concluded that it is difficult because it is an exceedingly complex problem and one which transcends engineering knowledge. To address these issues effectively requires a multidisciplinary approach to be developed. The challenge for civil engineers is whether they will be relegated to a position of provider of appropriate technical information and solutions or whether they can assimilate enough understanding of all of the issues to enable them to continue to fulfil the vision of the Founding Fathers of the Institution of Civil Engineers, which is to continue 'directing the great sources of Power in Nature for the use and convenience of man'

BANYARD POINTED OUT that current estimates are that 1,1 billion people on earth lack access to adequate water supplies and 2,4 billion to appropriate sanitation.

'Not surprisingly,' he said, 'the problem is split between the developed world and the developing and transitional countries. The science and technology of water supply and sanitation are well understood, although there remains the challenge of deployment of these technologies for poorer countries.'

'The developed world has evolved systems of management whereby fragmentation of water supply and sewage treatment provision is being replaced by a more regional approach. This may be through reorganisation or by the private sector providing the impetus. A further development has been the introduction of independent regulators to control the activities of private operators and in some cases even large public authorities (one example being Scotland).

'The standard of treatment achieved in the developed world is extremely high with requirements to meet demanding standards set by the European Union (EU) or the American Environmental Protection Agency (EPA)', said Banyard. 'Additionally, current legislation such as the EU Water Framework Directive will ensure that enhanced standards continue to be provided over the next 10 to 15 years.'

'However, in developed countries the wishes of environmentalists to reverse centuries of environmental pollution are likely to carry a high price,' he said. 'To this has to be added the cost of simply maintaining the standard of infrastructure that society in the developed world enjoys today.'

'Because all infrastructure has a finite life, it appears that over the next 20 to 50 years there will have to be a significant increase in spending on replacement of existing infrastructure compared to the level that is required today,' Banyard cautioned.

'It is interesting to speculate whether or not politicians and the public will accept this increased spend on water against the competing demands of transport, energy, education, etc, or whether a balance will be drawn between the aspirations for ever higher environmental standards and competing demands from other disciplines.

'The developed world has constructed its infrastructure over a period of over 150 years, and in doing so has been able to exploit the internal economy to provide the finance necessary to fund the provision of infrastructure. The current models of privatisation that exist in developed countries require the existence of a sophisticated financial market for their success. They are not readily exportable to developing and transitional countries.

'Further, private companies operating within the sophisticated financial markets have a finite limit to the extent of borrowing that they can undertake. This alone means they are unlikely to be able to bridge the financing gap that currently exists between government and institutional finance for developing countries and what is required to meet the millennium development goals,' he said.

'The sophistication of infrastructure provision and the very high standards in both medical and environmental terms demanded for potable water and sanitation in the developed countries contrast starkly with the levels of current provision in the developing and transitional countries. International effort has now moved from funding specific water and sanitation projects within the developing countries to one of seeking to reduce the level of poverty.

'The challenge of water and sanitation has to be seen against this background and is effectively a sub-set of the overall poverty equation.

'In general, funding is provided to countries to support their attack on poverty and it is for the countries themselves to decide whether or not that funding is deployed to provide water and sanitation. One result of this revision in policy is to reduce the profile of provision of water and sanitation.

'The problems to be faced in providing water and sanitation to developing and transitional countries are many and varied. The megaslums have proved too much of a challenge to many water based charities in the past, although this is now changing.

'Although there is much accord as to the basic principles that need to be adopted, such as community involvement, and the need to address water supply, sanitation and personal hygiene rather than any one of the issues, there are also significant differences between the approaches adopted by various organisations. These seek to magnify the complexity of the problem.

'No one can say which is right and which is wrong. In all probability they will all have their place but none of them will provide a universal model to be deployed, irrespective of geography and sociology,' said Banyard.

Banyard reiterated that 'there is a vast gulf between the standards of water supply and sanitation in the developed countries and those that exist in the developing and transitional countries. This gulf exists not only in terms of quality but also in terms of management approach, sophistication of financing, even in terms of basic health education. It is not possible to simply transfer solutions from developed countries and impose them on countries that are less fortunate. There are fundamental issues that have to be addressed which have nothing to do with engineering.'

He concluded that 'if civil engineers, or indeed any other engineering professionals, are to make a full contribution to the provision of water and sanitation in the developing world and thereby assist in the reduction of poverty, it is essential that they gain the skills and understanding to work with other professionals whose knowledge and contribution is at least as important and valid towards the goal of providing an overall solution as that of the purely technical experts'.

THE MILLENNIUM DEVELOPMENT GOALS

The Millennium Development Goals are supported by the UN and have the following objectives:

- Poverty: To halve, by 2015, the proportion of the world's people whose income is less than $1/day
- Hunger: To halve, by 2015, the proportion of the world's people who suffer from hunger
- Universal primary education: To ensure that, by 2015, children everywhere will be able to complete a full course of primary schooling
- Gender equality: Progress towards gender equality and the empowerment of women should be demonstrated by ensuring that girls and boys have equal access to primary and secondary education
- Child mortality: To reduce by two thirds, between 1990 and 2015, the death rate for children under the age of five years
- Maternal mortality: To reduce by three quarters, between 1990 and 2015, the rate of maternal mortality
- Major diseases: To halve, by 2015, halt, and begin to reverse the spread of HIV/Aids, the scourge of malaria and other major diseases that affect humanity
- Environmental sustainability: To stop the unsustainable exploitation of natural resources and to halve, by 2015, the proportion of people who are unable to reach or to afford safe drinking water

Within the Millennium Development Goals, there are a series of 'targets' including water, sanitation and water resource management, including the above aim pertaining to drinking water, and to reduce by half the proportion of people not having access to hygienic sanitation facilities by 2015.

Institution of Civil Engineers
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TCTA

SUSTAINABLE BULK WATER SUPPLY DEVELOPERS

Left: Overview of the Berg Water Project near Franschhoek in the Western Cape

Bottom: Outlet conduit: Berg Water Project

AT FIRST GLANCE, it seems incredible that a team of some 50 people can manage the liability on the Lesotho Highlands Water Project, fund and implement the Berg Water Project in the Western Cape and the new VRESAP pipeline construction in the Mpumalanga Highlands, while providing treasury management services to Umgeni Water. However, the TCTA has attracted top talent to achieve all of this in a multi-tasking team structure that takes pride in the quality of its service delivery.

TCTA was created by the government to implement the South African part of the massive Lesotho Highlands Water Project Phase 1: a 22 km tunnel from inside Lesotho to the Ash River and outlet structures on the Ash and Little Caledon rivers. Subsequently, TCTA was tasked to undertake the liability management of the entire project. Currently, the stock of debt under management is R20 billion, repayable over the next 20 years. The Lesotho project delivers a constant stream of high-quality water to the Vaal River system that supplies the water needs of six provinces.

The initial notice of establishment of TCTA limited its activities to the Lesotho project. However, TCTA's successful completion of the tunnel project (on time, within budget and at award-winning standards), as well as the success in designing and implementing strategic liability management practices, led the government to widen its scope of activities in March 2000.

Following a ministerial directive, TCTA has been providing treasury management services to Umgeni Water since July 2001. The initial scope has evolved to include the review of business plans, strategic objectives and core business focus areas to ensure that the treasury model supports their core business. The re-engineering of Umgeni's balance sheet and treasury operations was successfully completed in 2004 and the initial intervention has been transformed into a more strategic relationship based on a commercial contract.

IN MAY 2002 the Minister of Water Affairs and Forestry authorised TCTA to implement and fund the Berg Water Project (BWP) near Franschhoek in the Western Cape. This R1,6 billion project will provide almost 20 % more water to the integrated Western Cape water system by 2007. TCTA, the Department of Water Affairs and Forestry and the City of Cape Town signed a unique public-public partnership agreement that guarantees water delivery to the city by 2007 and repayment of the costs over a 20-year period. TCTA's funding strategy and tariff setting models provide water pricing stability to the city over the same period.

Owing to the tight time schedule and the prevailing foundation conditions, a con-

Dam construction on the right bank of the Berg River. The diversion channel is visible below left, behind the crane. The plinth is visible between the cofferdam and the main embankment. The borrow area is filled with water (right)

crete-faced rockfill structure was selected for the Berg River Dam. The main contractors mobilised in June 2004 and have stayed on schedule with the construction programme.

By mid-March 2005 the construction of the upstream cofferdam on the right bank was nearing completion while the construction of the 980 m long main embankment was well under way on the middle section of the flood plain on the right bank. On completion the wall will be 65 m high and 200 m wide at the base narrowing to 10 m at the crest. The upstream face will have a concrete membrane, while the downstream side will be seeded with fynbos, to minimise visual impact.

All the haul roads have been completed and the aggregate crusher plant is fully operational, as are the main and standby batch plants. Aggregate and rockfill material is obtained on site.

Excavation for the plinth has reached the design level in some sections and the placement of backfill has started. Meanwhile, the installation of dam instrumentation has started. Excavation for the river diversion is complete and the concrete works have begun. Concrete works on the dam include an inlet channel that leads into a 70 m high intake tower, and an outlet conduit comprising a 5,2 m diameter tunnel. By the end of September 2005 the Berg River will be diverted through the conduit, which will allow the embankment to straddle the river. Excavation for the spillway and the plunge pool is also in progress.

Good progress has been made in the removal of plant material from the dam basin; 20 % (114 ha) of the 570 ha has already been cleared. At the same time, Working for Water, a programme to remove alien vegetation from river catchments, is implementing the Assegaaibos project to clear the former pine plantation from the summits to the base of the valleys. TCTA signed a R21 million contract to fund part of the project over the next eight years.

In its endeavour to create opportunities for small local contractors to participate in the first economy, TCTA divided the contractors' housing contract for 80 houses into four multiples of 20 units. Preference has been given to local (Franschhoek and Dwars River valley) black enterprises and to companies that engage local black enterprises as joint venture partners. Two local SMMEs were awarded 20 houses each, while a BEE joint venture is responsible for the other 40 units.

MEANWHILE, in November 2004 the government mandated TCTA to implement and fund the R2,5 billion Vaal River Eastern Sub-system Augmentation Project (VRESAP). This 124 km water pipeline will provide additional water from the Vaal Dam to Eskom and Sasol on the Highveld of Mpumalanga. This fast-tracked project is due for completion in mid-2007. Construction will start as soon as the environmental approval process has been completed.

TCTA has not only built up a track record for successful funding and project implementation, but has also developed 'no-surprise' funding and water tariffing models within appropriate risk frameworks that make bulk water augmentation affordable to water boards and municipalities. Clearly, when it comes to sustainable bulk water resource development, TCTA has expertise and skills to make it happen. ◻

Rustenburg displays progressive municipal management

BY 2001 RAPID GROWTH in and around Rustenburg, caused mainly by increased mining activities in the area, had led to the local sewage purification works becoming overloaded. The effluent released into the Hex River had a detrimental impact on the raw-water quality of the Bospoort Dam, and since the Bospoort water purification plant was unable to produce potable water of an acceptable quality, the plant had to be closed down.

After calling for proposals, the Rustenburg Local Municipality (RLM) appointed the Mati ya Vanhu Consortium, consisting of Bigen Africa Consulting Engineers, Absa and Magalies Water, as its partners to solve the problem by the following means:

- refurbishing and upgrading the existing Rustenburg sewage treatment works from 22 to 42 Mℓ per day
- upgrading and refurbishing the Bospoort water purification works to allow it to cope reliably with the water quality in the dam

RLM did not have the financial means to fund the upgrade, so the consortium proposed the formation of a business unit, the Rustenburg Water Services Trust, to implement the refurbishments. Through the trust the project was fully ring-fenced and the rights and obligations of all parties clearly spelt out. The legal status of the trust is that of a municipal entity under the Municipal Systems Act. Funding was obtained from Absa Bank and the debt is serviced by the following means:

- selling effluent to the mines as process water
- selling potable water from the Bospoort water purification plant to the RLM at prevailing Rand Water tariffs
- charging RLM a tariff for sewage treatment

The combined income stream is sufficient to service all of the trust's debt as well as its operational and maintenance requirements. Any surplus funds generated will be allocated to the RLM to expand their water services. An interesting fact is that over the term of the agreements, the net sewage treatment tariff payable by RLM is envisaged to be substantially less than its own forecasted operating and maintenance costs of its sewage treatment works.

Magalies Water, as the third partner of the team, will be responsible for the operation and maintenance of all facilities. They will also take over the existing municipal water laboratory from RLM and incorporate it into their larger operation centralised at the Vaalkop water purification plant.

The three parties have, between them, a wealth of experience gained during the implementation of the R530 million Temba/Roodeplaat project for the City of Tshwane Metropolitan Municipality (see page 18).

The Rustenburg project, which recently kicked off with the official sod turning, is a great boon to that area. The mines will

FACT FILE

Trust members
Absa Bank, Bigen Africa Consulting Engineers, Magalies Water, Rustenburg Local Municipality

Contractors
Murray & Roberts Pty (Ltd)

Project value
R280 million

Completion dates
Rustenburg sewage treatment works
Phase 1: New 15 Mℓ/day activated sludge plant – May 2006
Phase 2: Upgrading of existing 10 Mℓ/day activated sludge plant to 15 Mℓ/day – November 2006
Phase 3: Refurbishment of existing 12 Mℓ/day biofilter plant – July 2007

Bospoort water purification works
Refurbishment of existing 12 Mℓ/day plant and pipeline to Rustenburg – February 2006

Bospoort Dam: Structural concrete commences for the GAC filters

New biological reactor excavation, the size of a football field

benefit from the reliable supply of industrial water, the economy will be stimulated through new property development, the community will enjoy better service delivery and, most important, the environment will be cleaned up.

It is a prime example of how innovative engineering linked to progressive municipal management and sound investment policies can work together to solve water and sanitation problems for local authorities.

Increased water supply to northern Tshwane areas

IN ORDER TO ERADICATE service delivery backlogs and increase water supply to the northern parts of the greater Tshwane area, the Roodeplaat/Temba Water Services Trust (RTWST) was established in 2003 as a municipal entity operated under the ownership control of the City of Tshwane Metropolitan Municipality (CTMM).

Temba water scheme

In an agreement reached with the CTMM, the RTWST would render bulk water supplies over a period of 25 years to the Greater Temba/Hammanskraal area and the municipal area of Moretele Local Municipality. Potable water would be supplied from the existing water treatment plant at Temba, which would be extended to double its capacity – from 30 Mℓ to 60 Mℓ per day – although peak consumption already reached 68 Mℓ a day, with the demand expected to grow substantially as service levels improved. Under the approved mechanism, the new Temba plant would serve not only the residential demand but would also supply water for industrial and commercial purposes, leading to economic development in the area.

The project included the feasibility, design, construction, maintenance and financing of the extended Temba water supply scheme. After completion of the extensions, additional raw water would be drawn from the Leeukraal Dam in the Apies River under licence from the Department of Water Affairs and Forestry.

Temba phase 5 extensions were completed and a taking over certificate issued to the contractor on 15 March 2005 (two weeks ahead of schedule). The newly commissioned plant was launched by the mayor of CTMM to the Temba community during Water Week.

Local communities have benefited directly from the project in terms of job creation. Much of the construction work was labour intensive and local expertise and labour were used to a great extent in the execution of the project.

FACT FILE

Participating partners
Absa Bank – financial underwriter and project sponsor; Bigen Africa Consulting Engineers – design consultant and project sponsor; City of Tshwane Metropolitan Municipality – ownership control; Magalies Water – operation and maintenance

Construction
WBHO Construction (Pty) Ltd

Total capex
Temba R198 million; Roodeplaat R332 million

Completion dates
Temba 15 March 2005; Roodeplaat – 31 August 2005

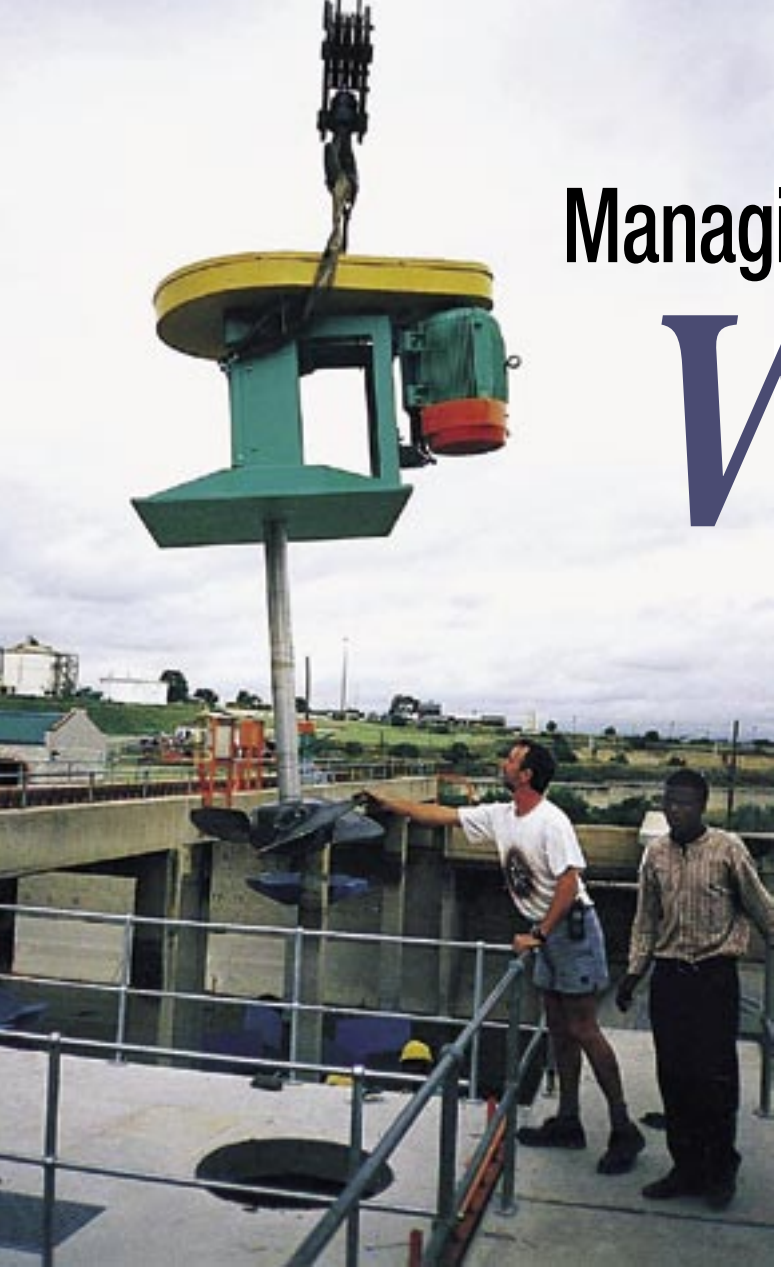
Roodeplaat water scheme

The Temba water supply project forms only one portion of the overall RTWST plan to address water shortages in the northern parts of Tshwane. In addition, there is the Roodeplaat water supply scheme which will extract eutrophied water from the Roodeplaat Dam, purify it and transfer it by rising main to existing bulk reservoirs in the CTMM area at Montana and Wonderboom. The project entails the construction of a new 60 Mℓ/day treatment works which is due to be implemented in August 2005. The total capex for the Roodeplaat scheme will be R332 million. □

Text Sonya Olivier
Africon

Managing a precious resource

WATER



WATER AND SANITATION are among the most critical challenges facing the African continent today. Whether it is due to water scarcity, lack of infrastructure, organisational constraints or community-based issues, there are severe backlogs in the provision of these basic services.

Africon's expertise in the arena of water and sanitation dates back 50 year and covers the technical, social and institutional aspects of water and sanitation. The company's multidisciplinary range of services in this regard is comprehensive, and includes surface and groundwater management, infrastructure provision, and expertise in the area of water and sewage utility services. Adopting an integrated approach, Africon harnesses its diverse skills base into focused teams to address clients' specific needs – providing clients with professional input for all project phases – from planning to operations and maintenance.

LOCAL PROJECT HIGHLIGHTS

Africon is involved in a wide range of water and sanitation-related projects throughout South Africa, as well as beyond the country's borders.

New life for Limpopo

Food security and poverty alleviation are key issues on the South African agenda today – particularly so in the country's remote – and often drought-stricken – rural areas.

A recently launched initiative of the Provincial Department of Agriculture to rehabilitate smallholder irrigation schemes in Limpopo Province is set to contribute to rural development, generate income, and help establish food production capacity in rural areas. The total capital value of infrastructure to be rehabilitated as part of the Revitalisation of Smallholder Irrigation Scheme (RESIS) project amounts to R300 million.

To ensure long-term sustainability of this worthwhile venture, the RESIS project also places considerable emphasis on improving the skills and capacity of smallholders to manage these irrigation schemes through continued training programmes.

Africon is responsible for the design, documentation and construction supervision for the rehabilitation of 12 of these schemes. Construction on four of the irrigation schemes located in the districts of Bohlabela and Sekhukhune started in March 2005.

Water debt recovery

Africon, in consortium with Leslie Madinga Associates, Stewart Scott International and SAB&T, is responsible for the planning, implementation and management of the national Department of Water Affairs and Forestry's (DWAF) Consolidated Outsourced Debt Collection and Cost Recovery Implementation Project.

This project involves establishing the amounts owed to the department for water use as well as the development of a coordinated plan to recover all water-related debt for the department. In addition, it aims to establish the outsourcing of debt collection functions (and cost recovery functions, where required) in the nine regional offices. Finally, the project team is also involved in facilitating capacity building to enable the department and its regional offices to take over the revenue management once the required functions have been established and rolled out successfully.

Says Africon's Francois Stander: 'The project success hinges largely on the buy-in from other government role players as well as the successful integration of a range of multidisciplinary skills.' The project is scheduled for completion in June 2005.

Improved revenue – improved service

Africon has developed an innovative solution for those local authorities experiencing an ever-increasing backlog in payment for services. Its improved payment strategy (IPS) has been used at a number of local authorities, of which Buffalo City in the Eastern Cape Province is the most recent.

Completed earlier this year, the project was conducted in joint venture with Utility Management Services (UMS), a local black economic empowerment firm, and resulted in streamlined debt management procedures, immediate cost recovery (a success rate of 70 % in immediate collection from defaulting debtors, as opposed to a lengthy legal process to recover debt), an integrated revenue enhancement strategy, and the revision of existing credit control and indigent management policies.

Francois Stander explains: 'Africon's IPS model brings together the main aspects of service delivery and sound business practices to improve levels of payment and ensure financial stability. The model follows a balanced score card approach, in which all elements that are necessary for the success of a utility service provider are assessed. The end result is a clear strategy to improve payment levels in a focused and prioritised way.'

Water planning

One of the greatest challenges facing the water industry in South Africa today is that of determining real needs and priorities, and ensuring that the money goes where it is needed most. DWAF is addressing this challenge by driving the initiative to develop Water Services Planning and Management Reference Frameworks for every province in the country.

Africon, in conjunction with a number of other industry partners, is involved in the development of the first-ever frameworks for water services for the Gauteng and the Northern Cape provinces. The ultimate objective of these reference frameworks would be to provide complete databases and spatial presentations of all information relevant to the entire water business for each province. By identifying actual needs and priorities, these frameworks would ultimately guide and assist DWAF, local government and other sector role players in decision-making around water issues.

Says Africon's Johan Potgieter: 'DWAF will use each framework document as a benchmark against which all Water Service Development Plans (WSDPs) for Water Service Authorities (WSAs) and funding applications would be assessed.' Potgieter explains: 'All metropolitan councils and local municipalities in Gauteng are required by legislation to develop a WSDP – a document that addresses all aspects of its water business and that is aligned with its Integrated Development Plan (IDP).'

Africon is also involved in the Water Service Development Plan Support Project in Gauteng, having been tasked with assisting DWAF's regional office, as well as those local authorities who are also WSAs, in establishing a planning culture, understanding DWAF's processes and developing WSDPs for these WSAs.

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Taken during drilling: water is lifted from the borehole using compressed air to give a first estimate on the yield of the borehole

Thousands will benefit from Eastern Cape groundwater find

Modern satellite imagery has helped identify greater than expected groundwater resources in the Emalahleni Local Municipal area. Fifteen boreholes have been sunk, one delivering an impressive 66 ℓ per second (airlift yield) – capable of filling an average-size swimming pool in only six minutes.

According to the project manager, Johan du Plooy, senior hydrogeologist in the East London office of SRK Consulting, this find at a depth of 75 m can deliver 90 000 ℓ (yield test rate) in an hour and beats all previous recorded water deliveries from boreholes in the Eastern Cape. He added that data is now being evaluated to establish the anticipated yield from the borehole over an extended period.

The borehole that has delivered record results is about 2 km from the White Kei River, which eventually merges with the Swart Kei to flow into the Great Kei River.

The work being done by SRK Consulting for the Chris Hani District Municipality is part of the Emalahleni feasibility study aimed at establishing surface and groundwater resources in an area within a boundary stretching roughly from Queenstown to Lady Frere, then to Indwe, Dordrecht and back to Queenstown. There are about 123 000 rural residents living in the area. SRK Consulting is responsible for establishing groundwater resources, and an assessment of surface water availability is being done by an East London-based consulting firm, Camdekon Engineers.

SRK Consulting is a South African-founded global group of consulting engineers and scientists that provides a comprehensive range of services to natural resource industries.

Speaking from his office in Queenstown, Mr Makaya Dungu, manager of the Water Services Authority, Chris Hani District Municipality, said the overall result of the assessment by SRK Consulting had exceeded expectations.

He said the Emalahleni Local Municipality was one of eight local authorities within the Chris Hani District Municipal Area, where there were about 810 000 people of whom 324 000 were without potable water.

In pursuance of national government policy to provide potable water and sanitation to all communities, the Chris Hani District Municipal Water Services Authority has already spent R33 million on improving existing services. During the previous financial year R116 million was allocated – and during the current year R136 million – by the national government for projects to provide potable water and sanitation to communities that do not enjoy these services, he said.

'The area that has been assessed incorporates part of the former Transkei, one of the areas with the greatest backlog. Now we are in a position to look forward and make arrangements to provide services to meet RDP standards,' said Mr Dungu. 'The groundwater identified is of good quality, and if we consider the borehole that is capable of delivering 90 000 ℓ per hour this alone will meet the needs of 10 800 households, or about 64 000 people.'

Giving some detail of the find, Du Plooy said 15 boreholes were sunk in the area, with a success rate of 86 %. Only two boreholes were dry and others, apart

The photograph was taken during a test performed on the borehole. The yield of the final stage of the test was 45 ℓ per second, with the water level drawn down to 46 m below surface, after six hours of pumping

Rotary air percussion drilling in progress at the site where the find was made

from the one that has exceeded all expectations, deliver up to 12 ℓ per second.

He said that among the previous best results in the Eastern Cape were a borehole drilled about 10 km from the latest find that delivered an airlift yield of 38 ℓ per second. This was found during work done for the Water Research Commission by SRK Consulting. He added that the measurement was taken during rotary air percussion drilling, using compressed air of about 21 bars, which provided an air lift delivery of water to the surface when striking the resource. In the latest find the final airlift yield was greater than 60 ℓ per second.

Another borehole, further north of the present site, provided an airlift delivery of about 40 ℓ per second and one in the Tsolo district, where SRK Consulting was also involved in an assessment of groundwater resources, delivered 30 ℓ per second.

In the latest find, the borehole was yield tested in order to determine the sustainable yield and this indicated an initial constant delivery rate of 25 ℓ per second over a period of 72 hours.

Satellite imagery

Du Plooy explained that the borehole was drilled on a target identified using modern satellite imagery, highlighting rock deformations below the surface. Interpretation of this information helped identify suitable targets for drilling. The target included two very prominent satellite lineaments associated with dolerite intrusions. These were then verified using the magnetic and electromagnetic geophysical methods.

'We are not sure that the borehole will continue at 25 ℓ per second. We now have to evaluate the data to establish the sustainable yield over a period of 20 years or longer. We need to establish how much water can be extracted constantly. Just guessing this might be 12–13 ℓ per second for long-term extraction, but we are still busy with our evaluations,' said Du Plooy.

He said the initial drilling had taken about a day and a half, but work continued for about a week and a half to increase the diameter of the hole and to put in casings and formation stabilisers.

The project team included Johan du Plooy (project manager and responsible for GIS analysis); Japie Coetzer (principal technician: geophysical investigation); and Jaco Pretorius (technician: geophysical investigation and drilling supervision), all in the East London office of SRK Consulting. The drilling contractor was B J Cilliers Drilling and the testing contractor Eastern Cape Water Contractors. ☐

Water Competition 2005

Technical Assistance

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AFTER THE TREMENDOUS SUCCESS of the Rand Water-SAICE Centenary Schools Water Competition in the past two years, Rand Water will once again provide the main sponsorship this year. The 2005 competition is up and running and we trust that SAICE's branches will once again come to the party 'big time!'

SAICE BRANCHES

Over the past two years many SAICE branches really went to a lot of trouble to get the schools in their region involved in this worthwhile project. It also afforded them the opportunity to speak to the learners about civil engineering and the role it plays in infrastructure creation and maintenance in South Africa. They were able to get maximum exposure for SAICE.

It is interesting to know that the 'competition' was actually used for team building by the Town Planners Association of SA. It has also become part of some schools' Science curriculum and is used during open days.

DATES

The results of the regional finals should be submitted by Friday, 12 August 2005. The finals will again be held at the Sci-Bono Discovery Centre in Johannesburg on Friday, 2 September 2005.

WATER DIVISION

SAICE's Water Division will again provide support where possible. They can be approached for assistance in sourcing the equipment and adjudication of the branch competitions. The winners of the branch competitions will once again be invited to the national competition.

We are looking forward to another exciting competition! We really count on your assistance to make this the huge success that it ought to be for the sake of the learners and the future of the civil engineering profession!

A letter and entry forms were e-mailed to all branch chairmen.

Rand Water signs MOU with Lilongwe Water Board

THE POLITICAL WILL and commitment from the South African government to support other African countries coupled with the amendment of the Water Services Act are opening opportunities for water utilities to spread their wings outside South Africa. The Department of Water Affairs is supporting and funding the process whereby South African water utilities can twin with their counterparts throughout the continent. The objective is to facilitate sharing of information and expertise leading to fast-paced regional development.

According to Thabani Myeza, business development manager at Rand Water, this process facilitated by the South African Water Utilities Association (SAAWU) has resulted in the signing of a memorandum of understanding (MOU) between the Lilongwe Water Board and Rand Water. This is one of the five agreements signed by various water boards, mainly in the East and Southern African Region.

Dr Simo Lushaba, CE of Rand Water, said: 'This is in line with Rand Water's commitment to support the New Partnership for Africa's Development (Nepad) initiatives of development and partnership. Rand Water, as the largest water utility in Africa with more than 100 years of experience, system has a lot to offer. The fact that it is widely accepted that it "benchmarks well and is nationally credible" is a motivation for it to allow other partners to draw on its skills and competencies. This is in the interest of Rand Water, South Africa and Africa at large.'

'Critical for the success of this partnership is that, with all the accolades that Rand Water has, we are not complacent. The objectives of the partnering are based on the concept of learning from each other. While Lilongwe has challenges and lags behind in some aspects, there are major lessons to learn from their experiences for Rand Water as well,' Dr Lushaba said.

At the signing ceremony the chairperson of the Lilongwe Board, Mr Harry Mkandawire, pointed that both the board and the Malawian government are excited about this initiative and fully support it.

Both parties agree that 'water is critical for the development of our continent and the economy at large. And such partnership will ensure the effective facilitation towards the achievement of the United Nation's Millennium Development Goals that commit countries to give the populations of their urban poor access to potable water by year 2015.'

While in the short term this is about information sharing, skills transfer and expertise, the medium- to long-term plan is based on specific areas of cooperation and will be project driven. These will focus on improvements of various areas including reduction of water losses, revenue management, policy issues, and peri-urban water service delivery. It is all about creating an environment where communities benefit and our organisations are sustainable in the future, no matter what challenges we face, Mr Myeza concluded. □

Focus on Stemele

THE B&A Group's water and waste water and effluent treatment divisions, under Stemele Bosch Africa (SBA), offer multidisciplinary consulting engineering services throughout sub-Saharan Africa. Munitech, another B&A Group company, specialises in operations and maintenance services in the same fields. Specialist consulting services include investigations, planning and feasibility studies, design, procurement, contract administration, construction monitoring and project management.

SBA's water division covers urban and rural water distribution, water treatment, river abstraction, dams, water services development plans and water resource studies, hydrology and flood control, as well as irrigation. The wastewater and effluent treatment division specialises in wastewater and effluent treatment works, pumps stations and pipelines; waste water reticulation, trunk sewers and rural sanitation.

'The B&A Group is committed to enhancing the quality of life of the communities that we serve and as part of this programme, the company plays an important role in providing appropriate solutions for water and sewage needs for millions of people in rural and urban areas,' says Max Stemele, managing director of SBA, who also sits on the B&A Group Board. 'The group has established a highly experienced team to develop technologies, systems and expertise to assist local government authorities to meet their service delivery obligations.'

A recent development for the B&A Group has been the establishment of Alliance Water Engineering (Pty) Ltd, a newly formed subsidiary company of Munitech (Pty) Ltd. This new division has been awarded a major contract by the Zululand District Municipality to manage, maintain and operate water and wastewater treatment works, as well as associated bulk infrastructure, for a two-year period.

'This contract provides a platform for the newly established company to build a sound reputation for service excellence and a base from which to pursue opportunities in the water services management sector,' says Sean Reilly, managing director of Alliance Water Engineering. 'With the collective skills, experience and resources of Munitech and the Alliance management team, the company is well positioned to become a significant factor in the management contracting and PPP environment in the water services sector.'

This ZDM contract, which is one of the more substantial water sector management contracts currently in South Africa, incorporates 14 water treatment works, 8 sewage treatment works, associated bulk distribution infrastructure and rural schemes encompassing some 11 pump stations, 59 km of trunk mains and 55 reservoirs.

The project incorporates a range of treatment works, in both type and capacity, from small works serving rural hospitals, to substantial works of up to 30 Mℓ/day serving extensive urban and rural areas. Responsibilities include the maintenance and operation of bulk distribution infrastructure in the Simdlandgentsha rural water supply scheme.

The B&A Group also provides local authorities with a full spectrum of resources and expertise to plan and implement water demand management programmes. SBA focuses on analytical, planning and design related elements, while Munitech's on-site and operational inputs are critical for effective water demand management planning.

These programmes incorporate all elements of demand management, including situation assessment, needs analysis, re-zoning, pressure control, zone metering and monitoring, water balance systems development and flow control. They also involve consumer meter auditing,

Bosch Africa

meter systems specification, leak location and repair, as well as consumer plumbing and repair programmes.

'We believe demand management programmes should be an integral part of the operation of any water supply system and should not be considered one-off projects that are implemented only if resources are available. The planning and implementation of water demand management programmes, that reduce the proportion of non-revenue water, is a fundamental responsibility of all water services authorities and providers. These structured programmes significantly improve the viability of water supply systems and reduce the cost of water to the consumer, at the same time conserving highly stressed water resources.'

The B&A Group, which has extensive experience in the rehabilitation, upgrading, operation and maintenance of municipal water supply and sewer systems, has recently been involved in water demand management programmes serving more than four million people in districts that include Umlazi, KwaMashu, Ntuzuma, Pinetown, Kwamakhutha, Inanda and Mabopane.

Construction of eThekwini Water Services' bulk water supply project at the Valley of a Thousand Hills, just outside Durban, is well under way and is programmed to be completed by the end of 2005.

'Stemele Bosch Africa is responsible for the design of the bulk infrastructure required to supply water to these remote rural areas, including Mkhizwana, Maphepheteni and Ekhukaneni, that do not presently have access to piped potable water supplies,' says Mohammed Vawda, a director of SBA.

'A feasibility study for supplying water to the area was undertaken by SBA on behalf of the municipality and various options for water supply, which included investigating local sources from springs, streams and boreholes, as well as piping in water from external sources, were evaluated.

'It is proposed that bulk water will be piped into the area from two sources – from the raw water aqueduct from Nagle Dam via a new water treatment plant in the west and also by extending the existing Inanda/Umzinyathi bulk water network from the east. Owing to the difficult hilly and undulating terrain, several pumping stations and numerous pressure zones will be needed for the scheme.'

The bulk water supply system will consist of a 1,3 Mℓ/day water treatment works, 20 reservoirs ranging in capacity from 25 kℓ to 650 kℓ, 11 pumping stations, and 83 km of steel and MPVC bulk supply pipelines, ranging in diameter from 75 to 250 mm.

The majority of the bulk water infrastructure is being constructed by eThekwini Water's construction division, while the water treatment works and pumping stations will be put out to tender. The reticulation network to consumers are being designed and constructed by eThekwini Water Services.

The bulk water supply project to the value of approximately R35 million is being jointly funded by the CMIP, DWAF and the eThekwini Municipality.

Sid Turner
Operations Director
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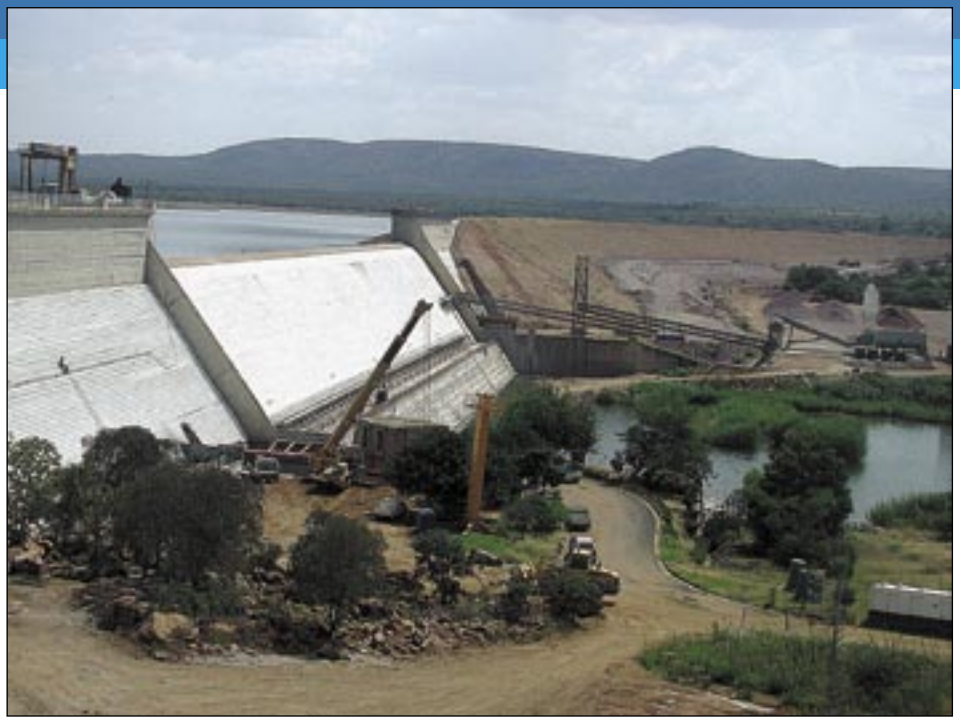
Flag Boshielo Dam raised by 5 m

The raising of the Flag Boshielo Dam in the Olifants River that is currently under way on the border of Limpopo and Mpumalanga provinces is one element of an integrated water resource development process being coordinated by the Department of Water Affairs and Forestry (DWAF) within the Olifants River catchment



The Flag Boshielo Dam in the Olifants River on the border of the Limpopo and Mpumalanga provinces is being raised to accommodate mining needs in the region

MINING AND AGRICULTURAL USAGE

Raising the supply level of the dam is motivated primarily by the water needs of existing and future mining developments in the region. These mining activities already contribute to the economic development of the region, employ local labour, earn foreign exchange and result in substantial tax revenue. Part of the project also entails the completion of a 1,2 km pipeline and the refurbishment of a 5 km canal which feeds into an irrigation system that is being developed for emerging farmers in the local communities. The pipeline and canal will service 1 000 ha of irrigable land.

The existing 104 million m³ dam, with a system yield of 56 million m³, was constructed in the mid-1980s for the former Lebowa government. The composite structure comprises a 770 m left-flank earth embankment, a 28 m high, 180 m long uncontrolled roller-compacted concrete ogee spillway with a roller bucket terminating structure, a 34 m high right-flank concrete gravity wall, and a 200 m long auxiliary spillway on the extreme right. The spillway arrangement has a discharge capacity of 7 400 m³ per second. At present the installed capacity of the outlet works at the dam is 6 m³ per second.

The design philosophy developed by DWAF for the raising of the Flag Boshielo Dam was strongly influenced by the needs of the sponsor and user of the additional water, the Lebalelo Water Users' Association, who represent the mining interests in the region with respect to water use issues. The primary considerations for the establishment of the design philosophy were identified as dam safety deficiencies, malicious vandalism and potential sabotage as well as maximum practical assurance of supply, implying that the risk associated with all aspects of the raising (including construction, operation and maintenance) should be minimised.

STORAGE CAPACITY INCREASED BY 80 MILLION m³

The raising of the full supply level of the Flag Boshielo Dam by 5 m will increase the storage capacity by 80 million m³ and the system yield by 16 million m³ per annum. Virtually maintenance-free rockfill material with an impermeable zone and an improved filter system will be used in the raising of the embankment and to enhance the stability of the existing embankment. A low operational risk/cost fixed raising option with roller-compacted concrete was the preferred choice for raising the main spillway and concrete non-overspill crest.

The optimisation of the auxiliary spillway has led to the final design choice of a four-phase 275 m long spillway with a fixed roller-compacted concrete sill. The combined discharge capacity of the main and auxiliary spillways is approximately 15 450 m³ per second. This is well above the 11 000 m³ per second safety evaluation discharge (SED) of the dam, but the additional capacity could be provided at a minimal incremental cost. Provision had been made in the existing outlet works to increase the discharge capacity to approximately 18 m³ per second. This capacity will be developed fully for environmental purposes with the added benefit of system redundancy in the outlet works to ensure a reliable water supply to all users.

In June 2003, the estimated construction cost of the raising, land purchase, relocation of infrastructure and professional fees was R234 million. Temporary work for 180 unskilled workers from the local communities has been created for the duration of the project. Site establishment by the main contractor, DWAF Construction, started in May 2004. According to the latest construction programme, the raising of the full supply level (FSL) is scheduled for September 2005 so that impoundment at the raised FSL can commence in the summer rainfall season of 2005/06. It is anticipated that construction will be completed by the end of March 2006. □

Text Marco Pauselli
Technical manager, African Gabions
Photographs Saipem

Alternative fill materials for the scour protection of underwater structures

Scour protection for underwater structures and pipelines, quay walls at harbours, and ports and cooling tower outfalls have almost always been designed with riprap, comprising high quantities of rock boulders of varying size diameters. The benefits that some alternative materials offer in these applications, such as stone-filled woven wire mesh gabions, have seldom been exploited to the full. We highlight the design and construction of the recently completed work at the Port of Soyo, in Angola, where scour protection for the expansion phase of the port was carried out using woven wire mesh gabion mattresses in conjunction with sand-filled geotextile bags

SOYO IS LOCATED in north-west Angola, on the south bank of the Congo River. The Port of Soyo is situated on the petrochemical logistical supply base of Kwande. In 2004 the current quay on the base was expanded to allow for three additional berths on the western section. The berths were sized to accommodate supply of Ulisse-type ships to the area. Saipem, who was awarded the construction for the quay extension, approached Maccaferri/African Gabions early in 2004 for an alternative solution to the riprap protection specified, as no rock was available on site and had to be imported at great cost. The ground at Soyo, situated just 12 m above sea level and close to the river mouth, consists mainly of fine sands that had washed down the river over the centuries.

Dredging an installation of the steel sheet piles

Arial view of Port of Soyo

The extension necessitated the protection of some 7 000 m² of seabed material at the entrance and exit to the berth from the currents generated during the manoeuvring stage by the forces of the propeller and bow thrusters of supply ships. The main function of the protection in front of the quay was to prevent the formation of a scour trench which could cause structural failure of the piled embankment.

TECHNICAL INFORMATION AND DESIGN APPROACH

The characteristics that were obtained for a typical Ulisse-type supply vessel were as follows:

- Max power, P_{max} 5 300 kW
- Power during manoeuvring (25 % of P_{max}), P_d 1 325 kW
- Propeller diameter (ducted), D_p 3,5 m
- Distance between propeller centreline and bottom of ship 3,0 m
- Minimum water depth below vessel 1,0 m

The geometry at the bottom of the seabed was unknown but assumed horizontal, since the extensions and retaining of the quay walls was undertaken using hydraulic driving sheet metal piles.

The design methodology adopted was according to the 'Guidelines for the design of armoured slopes under open piled quay walls' published in the proceedings of the 1997 Permanent International Association of Navigation Congress (PIANC). The report gives practical guidelines on design methods in a simplified form for everyday use in a commercial office, bearing in mind that only rarely can a berth be designed for a specific ship with known characteristics.

Step 1 – Scour velocity

In calculating the velocity at the bottom of the seabed, the formula for the centreline jet propeller velocity is as follows:

$$U_0 = c \left\{\frac{P_d}{D_p^2}\right\}^{\frac{1}{3}} \quad \text{where } c = 1{,}17 \text{ for a ducted propeller}$$

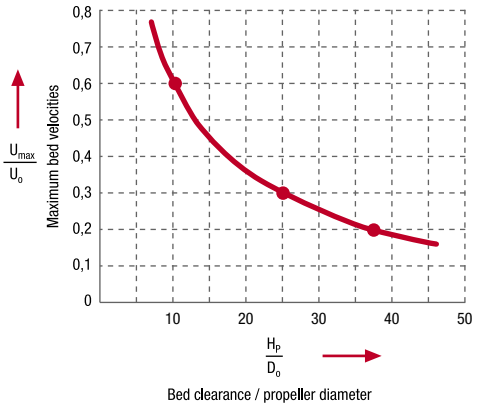
$$= 1{,}17 \left\{\frac{1\,325}{3{,}5^2}\right\}^{\frac{1}{3}}$$

$$= 5{,}57 \text{ m/s}$$

Once the axial velocity of the propeller is known, the seabed velocity U_{max} can be calculated from the graph below, provided H_p and D_0 are known.

H_p = 4 m
D_0 = 3 m
$\frac{U_{max}}{U_0}$ = 0,57 from the graph above

Hence U_{max} = 3,2 m/s



Step 2 – Scour protection

Since the eventual solution would consist of sand/cement-filled geotextile bags, the density of the soil material was taken as 20 kN/m³.

D_{50} = 0,5 m mean stone size

$$D^*_{50} = 0{,}5 \text{ x } \frac{(2\,650 - 1\,026)}{1{,}58 \text{ x } 1\,026}$$

$$= 0{,}5 \text{ m}$$

From the table, a boulder with D_{50} = 0,5 m equates to a weight of 200 kg.

Rock sizes (density 2,6 t/m³ or 25,9 kN/m³)

Weight	Equivalent sphere diameter (mm)	Equivalent cube side (mm)	Size by sieve, grizzly, or visual inspection (mm)
1 kg	90	70	80
5 kg	150	120	140
10 kg	190	160	180
50 kg	330	270	300
100 kg	420	340	370
200 kg	530	430	480
300 kg	600	490	570
400 kg	660	540	620
500 kg	720	580	660
600 kg	760	610	710
700 kg	800	650	740
800 kg	840	680	770
900 kg	870	700	810
1 t	900	730	850
2 t	1 140	920	1 050
3 t	1 300	1 050	1 200
4 t	1 430	1 150	1 330
5 t	1 540	1 240	1 420
6 t	1 640	1 320	1 500
7 t	1 730	1 390	1 600
8 t	1 800	1 450	1 660

Source: Shore Protection Manual

The guideline provides for the following grading of riprap: $0,5W_0$ to $2W_0$ = 100 kg to 400 kg boulders with a protection thickness of $1,5D_{50}$ to $1,8D_{50}$ = 0,75 m to 0,9 m thick protection

Step 3 – Substituting riprap with woven wire mattresses and geotextile bags

Tests undertaken at the Hydraulics Laboratory, Engineering Research Center, Colorado State University of Fort Collins, showed that gabion mattresses were able to perform the same function as a layer of loose riprap two to three times thicker and that the same performance could be attained by the gabion mattress using rock with lesser dimensions than those of riprap.

The ability of the mattress to resist movement by the current relies on its monolithic continuity to resist displacement and not its mass. The rocks inside the mattress are retained by the woven mesh wire. In general, when the velocity and shear stresses reach a critical magnitude, the rocks inside the mattress start to move in the main flow direction. The gabion mattress test results indicate that the woven mesh improved the stability of the filling rocks by doubling the critical shear stress compared to that for riprap alone.

Hence, the Shields parameter C* for the gabion mattress ~ = 0,1, while for the riprap C* ~ = 0,047.

These results showed that for protection of the seafloor, a 750 mm to 900 mm thick riprap protection layer could be substituted with a 300 mm thick mattress.

Since no rock was available on site, geotextile bags filled with a mixture of fine granular sand stabiliaed with a minimum of 6 % cement was recommended. Each geotextile bag measured 2 m long by 0,3 m high by 0,33 m wide, and in addition to providing temporary confinement of the sand during the filling operation, had to withstand the high initial construction and installation stresses. The bags were manufactured from a heavyduty, non-woven geotextile with a minimum weight of 270 g/m² and glazed on the external face to enhance the abrasion resistance characteristics and minimise filament disentanglement when subject to the scouring forces. A

total of 18 bags per 6 m x 2 m mattress were used, reducing the risk of complete mattress unit failure should one or more of the bags be damaged during installation. Once placed underwater, the sand/cement mixture would solidify to form soilcrete.

DURABILITY CRITERIA

Although every attempt was made to safeguard the wire from oxidation and corrosion, namely the heavily galvanised coating plus an additional 0,5 mm thick extruded PVC coating, much of the success of the solution depended upon factors such as design, construction and installation, and type of fill used.

If not given due attention early on in the proposed solution, each of the these factors may lead to eventual failure. Maccaferri's woven mesh has been certified by BBA (British Board of Agrèment) in certain cases to provide an expected life of 60–100 years, depending on the type of application. if the mesh is excessively damaged during installation, the expected life will decrease, but experience has shown that where the environment integrates around the mesh, the expected life is substantially increased. This has been verified by samples taken from project sites worldwide some 50 years after installation.

A case in point is the project at Thesen Island, in Knysna, where woven mesh gabion and mattresses were utilised for the 17 km of bank stabilisation and protection. Two years after installation, extensive marine life had encrusted itself to the PVC-coated wire. The wire in most places had been completely integrated into the marine environment, negating any possible effects of corrosion.

CONSTRUCTION AND INSTALLATION

Some 584 Reno mattresses were supplied to the Soyo project site, together with 43 000 m^2 of geotextile and a lifting frame complete with slings and hooks. In addition, special formwork to facilitate filling and closing of the geotextile bags was manufactured and delivered to the site. The formwork consisted of a single or double separator, which allowed for the filling of two or three bags simultaneously. The entire operation was carried out in two stages: stage 1 involved pre-filling all the mattresses required for the protection works, while stage 2 dealt with the installation of the mattresses under water.

The entire work area was pre-levelled before the mattresses were unbundled and folded out flat and the formwork was positioned inside the mattresses. Panels of geotextile that had been pre-cut were positioned inside the formwork before they weren filled with sand that had been premixed with cement to the correct ratio. The fill was compacted before folding over the overlap of the geotextile and stapling closed. Stainless steel staples with a pneumatic machine were used for this operation.

Encrusting of marine life on the woven mesh wire

The mesh is completely integrated within the marine environment

Filling operation

Closing and stapling operation

Once the bags were filled and closed (12 bags per mattress when using the single divider and 18 bags per mattress when using the double divider), the mattress lid was positioned, laced, and tied to the base, and all lacing wire was pulled taught and secured. Mattresses were stocked for later installation. Production rates achieved were in the order of 2 m^3 per man per day or 6,7 m^2 per man per day.

Where installation was adjacent to the quay, installation of the mattresses to a depth of 8 m was undertaken with the aid of cranes. For protection further away, the mattresses were installed with the help of a Grue LinkBelt crane secured on top of a barge. Installation rates averaged 162 m^2 per day calculated on a 9½ hour work day, with the maximum achieved of 336 m^2 per day.

Total time taken for the project was 81 days for the filling process and 36 days for the installation.

CONCLUSION

Soyo is not the first quay protection projuect undertaken with gabion mattress cages manufactured from woven wire mesh. Similar projects were undertaken at Limassol in Cyprus, Pemba Island in Tanzania, Port Louis in Mauritius, Mahe in the Seychelles, and Luanda in Angola, albeit with rockfill instead of sandfilled geotextile bags. The concept of utilising thinner protection layers where circumstances dictate has tremendous economic implications. The additional cost of gabions mattresses can be easily offset by the savings realised in reduction in rock volumes, and consequently cost of the rock; transportation of rock to site; and environmental cost of rehabilitating borrow areas. In addition less rock to position on site translates into potential time saving on the project. If these savings are passed to the client, more money will be available for additional work that may not necessarily have been budgeted for. □

Installation carried out by means of cranes and barge


Text **Hennie Kotze and Alex van Niekerk**
Senior project managers
SA National Roads Agency Ltd
Northern Region

AROUND PRETORIA

Innovative engineering solutions

WORLDWIDE, funding to improve, expand and maintain roads generally does not meet the demand. South Africa is no different.

To manage this situation, different approaches can be followed. A standards-driven approach implies that if one cannot achieve the required standard, nothing should be done. Another approach is to waive standards and do what is affordable. The first approach compromises the needs of the road user, whereas the second approach may seriously compromise the road user's safety and the function of a specific road, for instance mobility on freeways.

A balanced approach seems to be the solution. Basic engineering principles, innovative thinking, and engineering judgement should be applied to achieve optimum benefits for both the road user and the system. It necessitates the re-evaluation of so-called 'standard' engineering practices and requires engineers to 'design' and not 'compile' a solution to a specific engineering problem. The South African National Roads Agency Limited (Sanral) has since its inception in 1998 applied the principles of value engineering and appropriate standards. This has led to various innovative, although often controversial engineering solutions being applied. The following are brief overviews of four of these solutions.

WIDENING OF N1 PAST CENTURION

The 9 km section of the N1 between the Brakfontein Interchange, where the N14 joins the N1, and the Flying Saucer Interchange, where the R21 intersects the N1, past Centurion consisted of a two-lane dual carriageway freeway. The sections of the N1 to the south and north are three-lane dual carriageways resulting in this section creating a bottleneck effect that caused major congestion during the morning and afternoon peaks.

The congestion also resulted in a large number of accidents – some of which serious and/or fatal. Sanral investigated the widening of the road to a three-lane dual carriageway. Although this was a viable option, it would have meant that all the structures on this section of road would have to be widened to accommodate a cross-section of three 3,7 m wide lanes, a 3 m wide outside shoulder, and a 1 m wide inside shoulder. The estimated cost of this project, including an overlay on the road surface, would have been R55 million. This high cost was unacceptable to Sanral and also unaffordable at that stage.

Sanral then decided to investigate other alternatives. The most viable option was to only widen the road pavement itself and make optimal use of the existing width available on the structures. A cross-section of three 3,4 m wide lanes, a 1,7 m wide outside shoulder, and a 0,3 m wide inside shoulder could be accommodated in this way (figure 1).

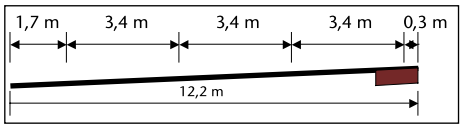


Figure 1 Proposed cross-section

To achieve the above cross-section the pavement was widened by 1,2 m on the median side of both carriageways. No widening of the bridge structures was required. Owing to the skewness of some of the structures and to create a wider inside shoulder at bridge balustrades, the lane markings were re-aligned over the structures to provide for a minimum of 1 m wide inside and outside shoulders.

Safety concerns, as a result of the narrower lane and shoulder widths, were mitigated through the implementation of a number of safety measures. An outside shoulder with a minimum width of 1,7 m was required to allow emergency vehicles to reach incidents. In fill conditions a 2,7 m wide paved area was created for stranded vehicles by moving guardrails further away from the road edge and constructing a 1 m wide concrete strip between the road's surfaced edge and the guardrails. The speed limit on this section of the N1 was also reduced from 120 km/h to 100 km/h. Improved law enforcement resulted in the successes achieved with this particular project.

Details in fill conditions

Reduced speed limit

Details at structures

Upgraded road section

This design was implemented in 1999 with the construction cost, including the overlay, being R22 million, less than half of the cost for the conventional solution.

Since the implementation of this solution the crash and fatality rate for the road section improved dramatically, bottlenecks at the entrance points to the section were eliminated, and traffic throughput in the morning peak hour increased from 5 900 vehicles before the upgrading to 9 600 vehicles afterwards – an increase of 62 %.

ON-RAMP LOOP AT ATTERBURY INTERCHANGE ON THE N1

The very high right-turn movement from Atterbury Road onto the N1 North, at the western terminal of the interchange, had a negative influence on the operation of the already congested interchange. The right-turn demand caused traffic backing up onto the freeway as well as in Atterbury Road, whereby the operation of other intersections on Atterbury Road (away from the freeway) were also negatively influenced.

Sanral set out to find a solution to the problem. Various more conventional solutions were proposed, but all at a very high cost. A left-turn free-flow loop on-ramp was then considered. In order to reduce cost, the loop had to fit in between the existing northbound off-ramp and the northbound carriageway of the freeway. The solution was

at Sanral

micro-simulated and proved to be – together with cross-sectional improvements at the other approaches to the interchange nodes – the optimum solution, given budgetary constraints.

A 25 m radius loop was constructed, as indicated in figure 3.

Various safety measures were introduced to prevent accidents on this narrow loop, such as providing a dedicated acceleration lane parallel to the through lanes on the freeway, lighting on the on-ramp, and COSBI-lines before the 25 m radius curve. The total cost of the project was R2 million.

The tables in the next column indicate the improvement in interchange capacity that was achieved.

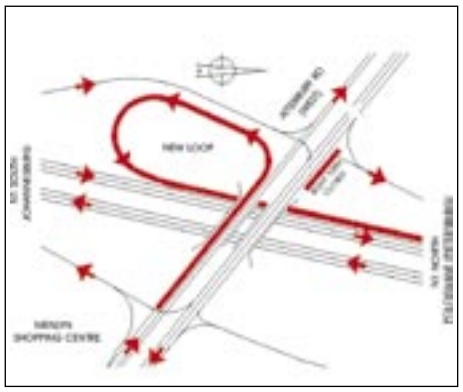


Figure 3

Acceleration lane

Lighting and COSBI-lines

Table 1 Actual improvements: western terminal

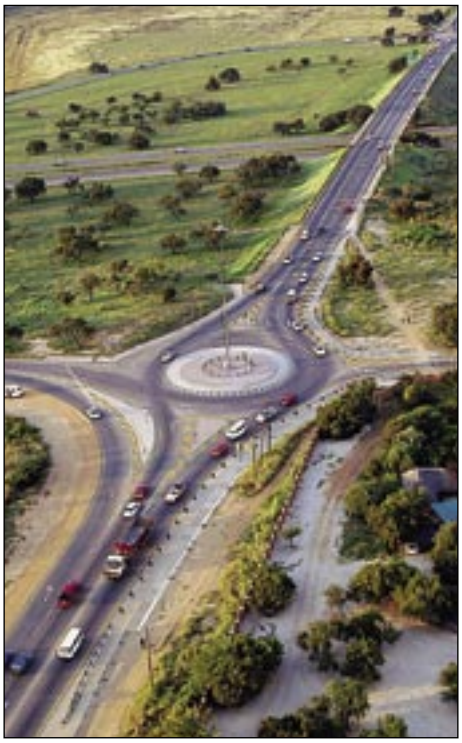
Increased turning volume from Atterbury to N1 (vehicle/h)			
	Before (right turn)	After (loop)	% change
AM	425	830	95 %
PM	640	870	36 %
Stopped delay (sec/vehicle)			
	Before (right turn)	After (loop)	% change
AM	50	30	–40 %
PM	91	42	–54 %

Table 2 Actual improvements for interchange

Increased volumes (vehicle/h)			
	Before (right turn)	After (loop)	% change
AM	11 125	13 370	20 %
PM	11 300	12 785	13 %
Stopped delay (sec/vehicle)			
	Before (right turn)	After (loop)	% change
AM	35	34	–3 %
PM	52	32	–38 %

TRAFFIC CIRCLES AT THE RAMP TERMINALS ON THE HANS STRIJDOM INTERCHANGE ON THE N4

Traffic movements at the ramp terminals at this interchange were one-way stop-controlled at the off-ramps. During peak hours, through-traffic movement on Hans Strijdom Road was such that N4 traffic struggled to exit or enter the off- and on-ramps, resulting in off-ramp traffic backing up onto the freeway.



Traffic circles on the Hans Strijdom Interchange

One of the most likely solutions to the problem would be to signalise the terminal intersections. Although this would have solved the peak period traffic congestion and turning hazards, it would have created unsafe situations during off-peak periods when vehicles would have to wait at traffic signals and motorists would be prone to possible high-jackings or smash-and-grab attacks, especially at night.

In 2003 Sanral investigated the conversion of the terminal intersections into traffic circles. Sanral was satisfied with the benefits of the solution. Apart from reducing delays at the interchange nodes, it also resolved the queuing of vehicles on the off-ramp onto the freeway. The traffic circles also had the added advantage that free-flow conditions could be maintained at all times. Both terminals were converted into traffic circles with a 20 m inside radius and two traffic lanes. Overhead lighting and other safety measures such as rumble strips, COSBI-lines and signage were also provided. The total cost of the project was R3 million.

The circles function well in peak hours with very little congestion and no back-up of vehicles from the off-ramps onto the freeway.

AND IN LIMPOPO: TRAFFIC CIRCLE ON THE N1 IN MAKHADO

The most northern intersection on the N1 in Makhado (Louis Trichardt) was four-way stop controlled. The intersection was prone to accidents caused run-away heavy vehicles approaching the town (and intersection) from the north from a steep downhill (mountain pass).

Sanral upgraded the two-lane single carriageway road (N1) through Makhado to a four-lane undivided road with at-grade intersections. The intention was to provide signalised control at the intersections.

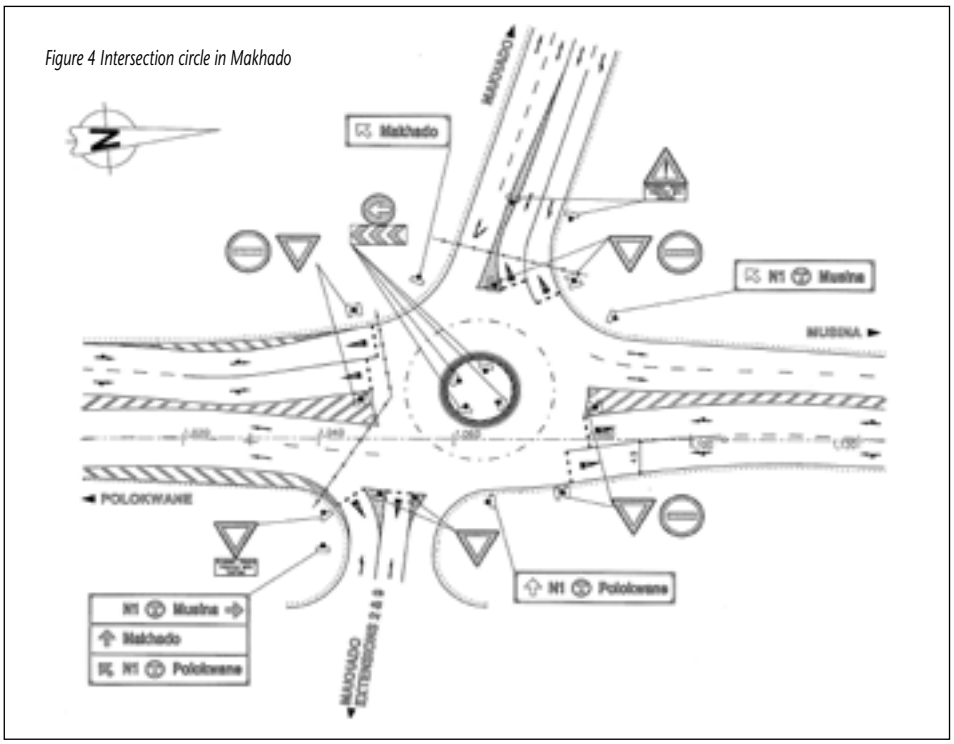
Although an arrestor bed was constructed at the foot of the mountain, approximately 1,7 km before the first four-way intersection, a fatal accident involving a run-away heavy vehicle (presumably ignoring the arrestor bed) and a bakkie occurred at this intersection. Sanral decided to re-evaluate safety options at the intersection. After specialist advice was considered, a solution was investigated to provide a traffic circle at this intersection.

Owing to limited funding, the topography of the area and that all the bulk earthworks and most of the layer works for the intersection were already completed, the circle had to fit inside the footprint of the intersection.

A circle accommodating two traffic lanes and an inside radius of 5 m could be placed inside the footprint of the new intersection. Figure 4 on page 34 is a schematic layout of the circle.

Although the circle would not stop run-away heavy vehicles, it has several benefits:

- It reduces the speed of all vehicles ap-



proaching the circle.

- It places a responsibility on motorists approaching the circle to be on the look-out for runaway vehicles (where a green traffic signal gives the motorist the 'right' to pass through the intersection without consideration for vehicles approaching the red light).
- It prevents, to a certain extent, the build-up of vehicles in right-turning lanes at signalised intersections. These vehicles could be prone to run-away vehicles colliding with them while they waited to turn.

The circle was constructed and implemented successfully at a marginal additional cost compared to the original intersection cost.

Although motorists initially had to go through a learning curve to be able to negotiate the circle, the feedback from residents of Makhado using the circle has been overwhelmingly positive.

CONCLUSION

These projects prove that by applying appropriate standards and value engineering, solutions to engineering problems can be found and implemented which under normal circumstances (set standards and no risk taken) would have been too costly.

Value engineering is not simply the application of reduced standards. It requires innovative thinking from designers and appropriate mitigation measures to address possible safety risks.

The 'appropriate' standards applied in some of the examples above should also not be perceived to be the new accepted standard by Sanral. Although some of the solutions applied might be repeated elsewhere, Sanral will always carefully consider the options available and endeavour to apply the highest appropriate standards on its road network. □

GALAXY RESERVOIRS REDUCING COSTS OF SERVICE DELIVERY

THE SBS GROUP of companies has announced the national launch of their Galaxy range of reservoirs, now available through their network of approved distributors.

'After seven years of research and technological pioneering into the South African water storage market, Galaxy now boasts more than 120 successful installations throughout South Africa, as well as in Lesotho, the Seychelles, the Democratic Republic of Congo and Angola,' says Delayne Gray of SBS. 'The Galaxy has made its mark and is poised to continue leading this market sector.'

The Galaxy is a prefabricated zincalume panel reservoir with a five-layer non-tear polypropylene fibre weave reinforced polyethylene/polyolefin liner.

Gray points out that what makes Galaxy an international trend setter in steel panel reservoirs with liners is their unparalleled ten-year non-leak warranty offered with all reservoirs. 'In addition, the Galaxy is always offered as a fully installed product with a zincalume dome roof, lockable access hatch and access ladder.'

'Use of zincalume high-tensile steel wall panels assures a product which is aesthetically pleasing, cost-effective and exceedingly durable when compared to traditional construction methods,' says Gray.

The Galaxy is easily transported to any site by means of an LDV and is easily installed on a very basic sand pad site or concrete ring beam in certain applications.

The speed of erection and simple commissioning procedure allows capacities of up to 300 kℓ to be completed in less than three days. Capacities of 2,6 Mℓ take a mere 22 days to complete.

The overall reduction in costs to rural water storage projects are phenomenal, making the delivery of services that much quicker and reducing the project management headaches for both engineers and main contractors.

'Owing to the modular design of the Galaxy reservoir, consistency of quality can be guaranteed every time, in all applications (rural, agricultural and commercial). The ever-increasing variables of poor workmanship, inefficient site management and unreliability of raw material supply are eliminated when using the Galaxy reservoir, thus assuring the success of the most crucial item of any water supply scheme, the reservoir,' says Gray.

Galaxy distributors are still required for some areas in Africa.

Delayne Gray 031-716-1820
delaine@sbsgroup.co.za

Sharecall 086-048-2657
www.galaxyafrica.com

info@galaxyafrica.com

ENSURING THAT GEOMEMBRANES ARE UP TO SCRATCH

THE RECENT PUBLICATION of SANS 10409 ('Design, selection and installation of geomembranes') is important news to all involved in water supply, waste disposal, and civil engineering projects that involve geomembranes. Together with SANS 1526 ('Thermoplastics sheeting for use as a geomembrane'), there are now two standards that are essential reading for anyone involved in using these extremely versatile liners.

A geomembrane is a factory-assembled structure of synthetic or natural polymeric materials, in the form of a sheet which acts as a barrier. The barrier function is essentially fulfilled by polymers. Geomembranes are used in contact with soil and/or other materials in geotechnical and civil engineering applications, says Kelvin Legge, a geomembrane specialist at the Department of Water Affairs and Forestry (DWAF).

Their extremely low permeability and resistance to chemical attack make geomembrane use attractive in structures for environmental protection, industrial use and social benefit. Geomembrane liners are thus used in conjunction with clay layers to line the bottom area of landfills so as to prevent contaminants migrating from landfills into the surrounding area and polluting ground water. Geomembranes are also used in engineering structures to contain valuable materials such as in industrial processes storage facilities and in heap leach mining applications. Geomembranes are also found in the linings of ornamental ponds and water features on golf courses, as well as in the water proofing of roofs, especially in car parks.

In brief, SANS 1526 and SANS 10409 address quality of manufacture and the utilisation of geomembranes, respectively. These standards are extremely valuable to the South African industry, as they offer a mechanism of measuring performance against a minimum standard to protect users against poor-quality products available on the world market.

Most geomembranes are thin, black in colour and their differences cannot readily be seen, thus the range of tests and required results give performance criteria to ensure longevity and security. SANS 10409, a code of practice, offers sound guidance on installation practices so as to ensure that the physical construction of barrier systems does not cause significant deterioration in the geomembrane performance for its particular application. The regulatory authority for landfills has recently introduced the requirement that where geomembranes are used for environmental protection in base liners, such geomembranes are required to comply with the SANS 1526 specification, says Legge.

Kelvin Legge, DWAF
Tel 012-336-8677
leggek@dwaf.gov.za

To purchase the standard(s)
Standards Sales T 012-428-6883

SIMPLE YET EFFECTIVE UNDERGROUND PIPE AND MANHOLE SEALING SYSTEM

THE PROFILED SEAL rubberised bitumen sealing strip from Profiled Sealing Systems is specifically designed to be used to seal the joints between concrete manhole rings.

'The Profiled Seal can be used where underground water would make the use of cement-based mortars impractical,' says Alan Brooks, MD of Profiled Sealing Systems. 'It will produce a much stronger joint than conventional cements mortars and is able to withstand shocks during the construction phase that would damage partially cured mortar. In addition, these seals are easy to apply and speed up manhole construction.'

The strips are packaged in boxes of 30 units of 1 100 mm. Three lengths will

complete one joint on a 1,2 m diameter manhole.

'The sealing strips are easy to apply using unskilled labour. There are no messy and sticky pastes, glues or putty to deal with. The strips bond to concrete and virtually any other materials likely to be encountered in the application, and can be applied during inclement weather,' says Alan. Initial adhesion is low to enable any changes to be made or misalignment of rings to be rectified. After about 12 hours the seal is watertight and will be broken only with difficulty.

According to Alan, the Profiled Seals provide a much stronger seal than cement mortars and are much more cost-effective than alternative products.

Alan Brooks
T 011-608-2813
082-562-8523
profiled@wol.co.za

MAJOR CONFERENCES AT AFRIWATER 2005

CELEBRATING ITS TENTH BIRTHDAY, Afriwater – the largest water, waste and environmental technology exhibition of its kind in South Africa – will be held at the Sandton Convention Centre from 10 to 12 August 2005.

Worldwide, supplying clean water to individuals and companies is now a $400 billion per annum industry – 40 % the size of the oil sector and one third larger than the global pharmaceutical industry. And in South Africa, of the estimated 45 million people currently living here, six million still do not have access to this life-giving source and nearly 16 million are without adequate sanitation.

With the pressure now on for the local water and sanitation industry to meet targets for management, protection and delivery to all, and additional emphasis now being placed on ensuring the sustainability of our water resources to ensure the continuing growth and prosperity of our people and our country, Afriwater 2005 is perfectly placed to confront the industry's challenges and some answers.

Running alongside this exhibition, international conferences will be hosted to enable South African and other African water practitioners to become more closely aligned to first world trends in water and sanitation management.

The Diffuse Pollution Specialist Conference is being hosted by the International Water Associationn (IWA). The Diffuse Pollution Group of IWA promotes research, disseminates information, and supports the development of policy to understand and solve contamination of natural resources by diffuse pollution sources. Spearheaded by the IWA Chairman of Diffuse Pollution, Dr Ralph Heath, and working in close collaboration with the Water Institute of Southern Africa, the conference will concentrate on international technologies, as well as locally developed solutions, for measuring and managing the world's major pollution source.

The Management of Residues Emanating from Water and Wastewater Treatment Conference will focus on the sustainable management of all residues emanating from the treatment of water and wastewater, that is, sludges emanating from the treatment of potable water, domestic wastewater and industrial effluents, and processes generating concentrates and brines. The conference will focus on both organic and inorganic residues emanating from the treatment of water and wastewater (domestic and industrial). Themes include sustainable management of residues emanating from water and wastewater treatment; management aspects; minimising water and wastewater residues; treatment technologies; reuse/ final disposal; sustainable management in developing countries; and economical aspects.

Conferences
Anne Biddlecombe on 011-254-4800

Afriwater
www.afriwater.co.za
lynnk@exhibitafrica.co.za

WATER TREATMENT CHEMICALS

ROHM AND HAAS, a global speciality chemical company, has appointed Chemfit Industrial Holdings and subsidiary companies as the exclusive distributors for the company's range of industrial water treatment chemicals in sub-Saharan Africa.

Rohm and Haas manufactures a wide range of water soluble polymers under the Acumer, Optidose, Orotan and Romax trademarks and biocides under the Kathon and Klarix name. These product ranges are designed to meet any requirement in diverse water treatment applications, including boilers, cooling circuits, surface treatment, pulp and paper plants, and oilfields.

Acumer polymers are clear, thermally stable scale inhibitors used for the control of calcium carbonate, calcium sulphate and barium sulphate scales in process and drinking water. They are also designed to control oxalate scale in the sugar industry and silica-based scale.

The Optidose range consists of specially marked Acumer polymers, which enable users to determine the level of polymer available to control scale formation, resulting in more cost-effective treatment. The Orotan range is used as scale and iron oxide dispersants in process water and tall oil recovery aids in the pulp industry. Control of carbonate and sulphate scales and removal of residual oil in water in oil field applications are covered by the Romax range.

'Rohm and Haas also manufactures a wide range of high-performance broad-spectrum antimicrobial agents, based on the isothiazolone mole-

cule, under the Kathon and Klarix trademarks,' says Dr Craig Bosch of Chemfit Fine Chemicals. 'This chemistry is supported by a package of regulatory approvals and environmental fate and toxicology data, which was awarded the US Presidential Green Chemistry Challenge Award for excellence in environmental achievement.'

The Kathon range includes the copper-stabilised WT and copper-free CF mixed isothiazolones, designed for water treatment and paper mill applications. Klarix 4000 was developed to control algal and fungal growth in water treatment and paper mill applications. The microbiocides are compatible with most types of water treatment polymers and produce no gelling, discolouration or odour. They break down into non-toxic compounds and do not contain or release formaldehyde. All these biocides are FDA and BGVV compliant.

The water treatment product range is complemented by the extensive range of ion exchange resins supplied by Rohm and Haas.

New to the range is a modular ion exchange-based water deionisation system – Advanced Amberpack™ ADI-60 – that makes it even easier for water management experts to provide a continuous flow of pure, deionised water for industrial use in power, chemical, petrochemical, paper and electronics industries.

Rohm and Haas, with over 50 years in water treatment, has designed a self-contained, skid-mounted deionisation system, which can be delivered in a standard shipping container or trailer and is easily plugged in on site. This deionisation module, consisting of flat head service vessels, a regeneration system, a rinse recycle pump, PLC automation and an optional membrane degasification system, is able to produce a continuous flow of deionised water, with up to 98 % water yield.

The company estimates that application of this water treatment system will enable the re-use of 121 million litres of wastewater a year, or roughly enough water for 100 000 families for one day.

Craig Bosch
Chemfit Fine Chemicals
T 011-918-1900
082-418-3197

NEW CMA PRESIDENT

WALLY ARMSTRONG has been appointed president of the CMA (Concrete Manufacturers Association). He has had a long association with the CMA, previously having been vice-president of its PIPES Division, a position he held since 2000. Under his guidance the division was transformed into one of the most proactive and progressive within the association.

Armstrong has spent 34 years in the pipe industry, having worked for Armco and then, over the past 21 years, for Rocla, where he rose to the position of marketing director.

He was instrumental in assisting Rocla maintain its position as the market leader in concrete piping and has played a major role in the development of the concrete pole industry in southern Africa. He was also involved in the establishment of the Rocla Academy for the transfer of skills to emerging contractors.

In addition to his work with the CMA, Amstrong runs a marketing consultancy.

CMA UPDATES CAVITY WALLS DETAILING MANUAL

THE Concrete Manufacturers Association (CMA) has updated Volume 3 of its detailing manual on concrete masonry, *Cavity Walls*. Volumes 1 and 2, which have already been updated, cover single leaf solid unit walls and single leaf hollow unit walls respectively.

CMA director John Cairns says Volume 3 is aimed at providing engineers with guidelines on the detailing of cavity walls of between 240 mm and 290 mm wide.

'Successful masonry depends on good designs and material specifications, sound construction technique and an acceptable quality of workmanship. Good workmanship is in turn dependent on access to accepted norms of local detailing practice and the use of materials which meet standards laid down by the SABS,' says Cairns.

Cairns stresses that the booklet should be read in conjunction with the CMA's Masonry Manual, as well as the National Building Regulations, the National Home Builders Registration Council's Home Building Manual, and all relevant South African Bureau of Standards specifications and codes of practice.

'The details in the manual are intended as a guide only. Each construction situation is unique and there are many factors to be considered before a detail is finalised – far too many for inclusion in this manual,' adds Cairns.

Items covered are sills, lintels, window frames, door frames, suspended floors, roof trusses, roof slabs, parapet walls, masonry bond patterns, joint profiles, and column intersections.

Order from Pam Zukor – CMA
T 011-805-6742
cma@mweb.co.za

SA, ZIM AND BOTSWANA FORMULATE JOINT RESEARCH PLANS

RESEARCHERS AND research managers from South Africa, Zimbabwe and Botswana met in Zimbabwe recently for the first technical workshop of the Regional Research Alliance (RRA). Participants developed a short- to medium-term plan within the three research focus areas of the RRA (water and food security; energy; and construction and infrastructure).

Possible project areas include groundwater and rainwater in southern Africa; innovative, alternative water treatment technologies; energy management; mapping energy resources; and building codes, standards and specifications.

South Africa's CSIR leads the team that will draw up research project plans in the field of water and food security. Zimbabwe's Scientific and Industrial Research and Development Centre (SIRDC) manages the energy research team, while the Botswana Technology Centre (BOTEC) takes the lead in construction and infrastructure.

CSIR experts serve on all three teams – Dr Joy Leaner heads the water and food security team, Mongameli Mehlwana is part of the energy team, and Rudi Kuhn is involved in construction and infrastructure.

The RRA board will meet in June to review progress of the teams and to discuss the strategic direction of the alliance.

TEXTBOOK FILLS VITAL TERTIARY NEED

SINCE THE BEGINNING of this year, more than 1 500 copies of the Cement & Concrete Institute's *Fundamentals of Concrete* textbook have been distributed free of charge, mainly to previously disadvantaged students at South African universities and technikons.

C&CI has been able to make the textbook – which normally sells for R110 each – available free of charge to needy students as a result of a sponsorship by the Institute's members, which include the major cement producers.

The textbook is aimed at undergraduate students of engineering, building management, quantity surveying, and architecture who has concrete technology as a syllabus subject. The free distribution of the textbook has been controlled by lecturers at the tertiary educational institutions.

Fundamentals of Concrete covers the properties of fresh and hardened concrete, mix proportions, QC, construction practice, sand-cement mixes, and appearance of concrete.

Universities and technikons requiring more information about the C&CI service should contact Jean Sharman on T 011 315 0300, or jeans@cnci.org.za

The SAICE baobab

IT WAS A SLOW AND UPHILL STRUGGLE to get to Thornhill 19! We have therefore chosen not the quick-growing and shortlived thorn tree, but the solid baobab to be the carrier of our building-donation 'bricks' in the form of small plaques. We have also chosen the precious metals that South Africa is blessed with to represent the levels of donation. And we have chosen the unique indigenous wire art form for the tree.

A baobab can only be planted if there is hope for and expectations of a future. Over many years, it grows beautifully, albeit slowly, withstands the most severe droughts, and becomes majestic. It provides shelter, food and is a beautiful object in the eye of the beholder. It is solid and grand in stature; it is also a model of sustainability.

These characteristics are similar to those of SAICE. Even if it grows slowly, it will become just as magnificent as its brothers and sisters in the bushveld of South Africa.

Dawie Botha

Left: The baobab symbolically carrying the 'bricks' donated by members

Left: SAICE by night

Below from top to bottom:

- *In the basement of the new building. Rumour has it that Dawie painted the floor himself …*
- *Mike Deeks presenting the Hon Lemias Mashile, MP, with SAICE's* Foundation for the Future
- *At the first Council meeting in the new building: Sam Amod (president elect), Mike Deeks (president) and Dawie Botha*
- *Work in progress*
- *Recipients of the Executive Director's Awards: Big Branch – Syd Turner, Durban; Medium Branch – Geoff Roberts, Algoa; Small Branch – Hannes de Kock, Upington; Division – Chris Waygood, Environmental*

Our own building!

SAICE's new National Office building was officially opened on 13 April

Dawie Botha, executive director of SAICE, stressing a point while addressing members at the opening ceremony

Taking possession of what is theirs – Dawie Botha, Allyson Lawless and Mike Deeks, 2005 president of SAICE, with Olaf Holtung of Barrow Construction at the back

Still wanted
retired or available civil professionals!

SAICE, FUNDED BY CETA, has been carrying out a major research campaign to determine the number of engineers, technologists and technicians who are operating in the civil engineering field.

In the past, the SAACE and SAFCEC headcounts were normally regarded as being representative of the industry, but civil staff are to be found in all levels of government, parastatals, the supply chain, mining and industrial, academia, non-residential and home building, etc.

Few sectors or companies do not complain of being short of experienced technical staff. Equally, there are few companies that escape the pleading letters from young students begging for vac work, experiential or workplace training.

A call was made last month for additional capacity among the ranks of the recently retired and in small companies to offer their services to mentor or, more correctly, 'knowledge coach' young people, or assist with initiating and managing projects.

Some 40 engineers have already offered their services.

Making government departments aware of the capacity available has created much interest. We are now busy developing policies on how staff will be used. Each mentor will be assigned two to four young graduates. They will be responsible for putting graduates through their three-year workplace training in preparation for ECSA registration, and will also advise on the implementation of the many projects which have not been rolled out due to the lack of capacity.

This intervention is so vital that we appeal to anyone with capacity and the energy to tackle these challenges to submit their abridged CVs to Allyson Lawless at allyson@ally.co.za.

Making government departments aware of the capacity available has created much interest. We are now busy developing policies on how staff will be used. Each mentor will be assigned two to four young graduates

Who's Who at
Thornhill Office Park 19

Dawie Botha
Executive Director

Carla de Jager
Manager Education & Training

Lungelwa Lamani
E&T Officer: Courses

Dawn Hermanus
E&T Officer: Professional Registration

Angelene Aylward
E&T Officer: Bookshop

Memory Scheepers
Manager Administration (Membership etc)

Elsabé Maree
Administration Officer

Fridah Mahlangu
Reception

Merriam Molefe
Cleaner

Joanne Laas
Consultant

Debbie Griesel
Manager Finances

Daleen Coetzer
Bookkeeper Debtors

Magda Bruyns
Bookkeeper Creditors

Zina Girald *Communication Officer*
(Bridge Building, Awards, Website)

Marie Ashpole
Communication: Media Liaison

Verelene de Koker
Communication: Magazine and Journal

President's Award for 2004 to John Lane

JOHN WILMOT LANE received SAICE's President's Award for meritorius service to SAICE and for significant ongoing contributions to the civil engineering profession (2004).

John is a civil engineering graduate of the University of the Witwatersrand and has been actively involved in the field of structural engineering since the late 1940s. He is currently 81 and is still just as active and interested in the profession as he had been during the eighties and nineties.

John Lane receiving the President's Award for 2004 from Faried Allie

His career involved consulting, contracting, working for the Portland Cement Institute in southern Africa and the Concrete Masonry Association (now Concrete Manufacturers Association). Two of his passions are cement and concrete masonry. He has worked tirelessly on technical committees to further the science and technology of concrete masonry and has authored numerous publications in this regard. Generations have benefited from John's effort and influence as he had participated at many conferences and committees and had lectured countless students on the subject. He still continues to lecture at technicons and universities and actively participates in the work of StanSA technical committees and the development of technical literature in his fields of interest. John has played a major role in introducing quality concrete masonry in South Africa.

John is a former deputy director, Portland Cement Institute, Rhodesia (Bulawayo)(1959–1964), a director of Portland Cement Institute Central Africa (Bulawayo) (1965–1975), a deputy director of Portland Cement Institute, South Africa (1975–1985), and a director of Concrete Masonry Associated (1985–1992).

He was formerly president of the Rhodesian Institute of Engineers (now Zimbabwe Institute of Engineers), the chairman of the SAICE Structural Division in 1983 and, for many years, the chairman of the Joint Structural Division's standing committee on masonry. He was also a recipient of a fifty-year IStructE service award.

DIARISE THIS!

Event	Date	Deadline for submission of papers	Venue	Contact
Technical Report Writing	4–5 July 13–14 July 11–12 August		Cape Town Midrand Durban	Lungelwa Lamani*
Obtaining Environmental Authorization: A Strategy	1–14 July 2005		Midrand	Lungelwa Lamani*
Assertiveness and Conflict Resolution for Managers	2–3 August 2005		Midrand	Lungelwa Lamani*
Handling Projects in a Consulting Engineer's Practice	4–5 August 2005		SAICE National Office (New Building), Midrand	Lungelwa Lamani*
X-Pert Proactive Management and Planning	15–18 August 2005		Centurion	Lungelwa Lamani*
SAICE Wits/Pretoria Afternoon Lecture Course	3–31 August 2005 7–28 September 2005		SAICE National Office	Lungelwa Lamani*
Negotiation Skills	2–26 August 2005		Midrand	Lungelwa Lamani*
Concrete Durability *(one day)*	13 September 2005		Contest Concrete Technology Services, Durban	Antoinette Marais T 031-700 9394 antoinettem@contest.co.za
Catchment Management: Rules of Engagement Conference on Public Participation in Developing Catchment Management Strategies	18–20 September 2005	Deadline for Abstracts 20 July 2005	Misty Hills Country Hotel Muldersdrift, Johannesburg	Carla de Jager T 011-805-5947 F 011- 805-5971 cdejager@saice.org.za
Landfill 2005 Conference	20–21 October 2005		Rob Roy Hotel, KwaZulu-Natal	Lia Russell T 031-717-2300 F 031-702-0435 ktechptn@kaymac.co.za
4th International Conference on Unsaturated Soils	2–5 April 2006	Abstracts 13 May 2005 Draft papers 15 Aug 2005	Carefree Resort & Villas Carefree, Arizona	Robert Silverstein T 703-295-6234 rsilverstein@asce.org www.asce.org/conferences/unsat06 Gerald (Jerry) Miller gamiller@ou.edu

Lungelwa Lamani 's details: T 011-805-5947, F 011-805-5971, llamani@saice.org.za