

DBSA: Ensuring Water and Food Security

The Water Crisis: A Professional Organisation's Perspective

by

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1. INTRODUCTION

Increasing water scarcity creates enormous challenges in equitably allocating this precious resource to competing sectors. Provision has to be made to sustain essential economic growth both for present and future generations, while at the same time securing basic human needs, meeting international obligations and protecting the resource and the fragile environment that it supports. This calls for integrated management and implementation of the highest order.

The 1998 National Water Act (NWA) provides a comprehensive legislative platform for achieving these ends. As such we have little specific comment to offer regarding the Act itself. However, a number of far reaching concerns have arisen regarding the implementation of the Act and the capacity of the organisations charged with this task.

The South African Institution of Civil Engineering (SAICE) and the Water Institute of South Africa (WISA) together represent most of the professional water engineers and water scientists in South Africa. These organisations took the unusual step of preparing a joint submission because they recognise the crucial strategic importance of water in our land and wish to lend weight to the grave concerns regarding what many responsible practitioners from diverse quarters can only describe as a national crisis of the first rank.

We understand from the letter of invitation that the purpose of the Portfolio Committee is to review *“the legislation to ascertain implementation, challenges and possible areas of improvement to the Act”*. In view of the deep and urgent concerns of our members, it behoves us to focus almost exclusively on the first two aspects, namely implementation and challenges, rather than on what would be mostly cosmetic changes to the legislation itself.

Our concerns are set out under the following headings:

- Who is planning?
- Water quality
- Ageing Infrastructure
- Capacity and skills

The issues discussed under each of the above sections could be exacerbated by the overlay of new challenges:

- Climate change

This is followed by a section dealing with the way forwards:

- What next?

2. WHO IS PLANNING?

We acknowledge from the start that DWAF’s planners are doing the best they can in difficult circumstances with limited resources. However, there is clear evidence that planning is not keeping up with changing circumstances and that the implementation of plans is falling behind at various levels.

2.1 Link between water demand and water resource planning

Local Authorities (LAs), through their Water Services Development Plans (WSDPs), should provide the Water Boards (where they exist) and ultimately DWAF, with

projections of water demands and indications of how they are expected to be met. DWAF is responsible for developing the resource to meet these demands. In the face of increasing water scarcity, the unquestioned matching of escalating demands could become unsustainable, or at least very expensive to achieve when increasingly distant resources have to be tapped. Under such circumstances the DWAF needs to point out the economic and practical implications and may suggest the need for Water Conservation (WC) and Water Demand Management (WDM) measures. A healthy feedback between the two authorities should ensue, leading to the adoption of a viable and efficient plan.

But here we need a reality check. Can we be sure that the LAs and Water Boards plan and communicate their needs? Are they responding to calls for WC and WDM?

All of this raises the crucial question of who is putting it all together? We understand that the National Water Resources Strategy (NWRS) should address the availability of the resource and the steps to be taken to meet demands – or indicate where they cannot be met. They should be informed by the WSDPs provided by the LAs. But are the WSDPs being prepared and are they based on reality? And are they addressing the critical issues?

It is apparent that inconsistencies and implementation failures have led to extremely serious problems.

2.2 The Vaal River system

Much of the Gross National Product (GNP) of South Africa is generated within the Vaal River catchment and in the areas to the north that are dependent on the Vaal River system for their water supply. The economic and strategic importance of this complex water supply system cannot be over-emphasised. Failure of this crucial water supply will directly demolish the hopes for poverty alleviation for millions in this region and deprive the fiscus of the economic resources required for this throughout South Africa.

Against this background we view with deep concern the statement by DWAF's Director General (DG) regarding supply to Gauteng (which of necessity applies equally to the entire Vaal River and Crocodile West system):

“Unless we do something about the current growth trends and needs, we are going to have a water shortage by 2013”

“But even with the fastest implementation, these [projects] will only be ready by 2019”
Engineering News 26 September 2008

This portends a **national crisis of the first order**.

2.3 The Mgeni River system

The Mgeni River system supplies water to the second largest economic region in South Africa. After the Vaal and Mgeni river systems, the GNP generated in the rest of the country almost pales into insignificance.

Yet it has come to our attention that this region is now only has a 92% assuredness of supply with about a 1 in 13 year risk of facing severe water restrictions. Figure 1 shows that the users of this system have been in a precarious deficit situation for the

MGENI SYSTEM: WATER RESOURCE REQUIREMENTS 99% LEVEL OF ASSURANCE

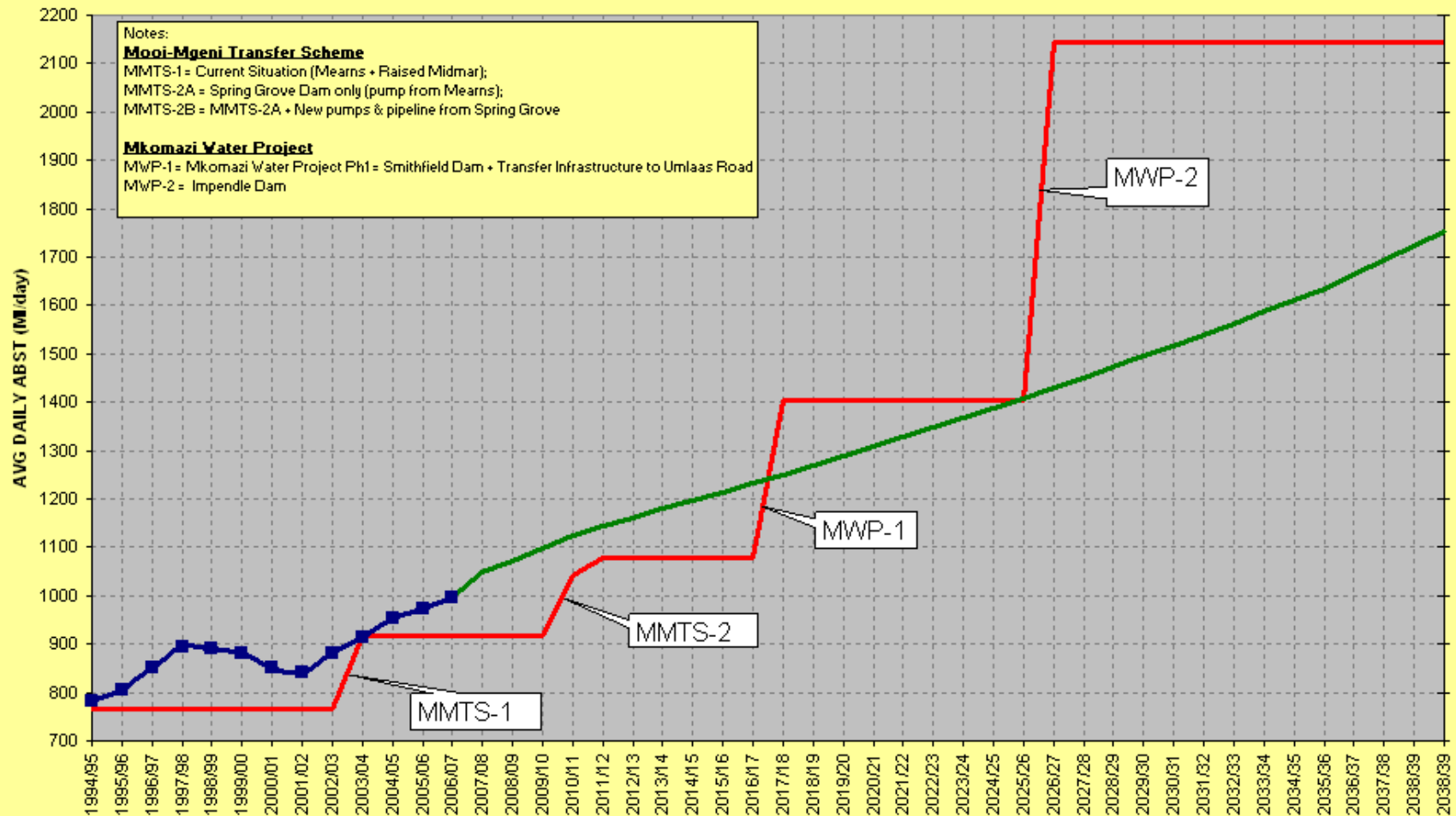


Figure 1: Demand - supply curves for Mgeni River

last 4 years. Spring Grove Dam (Scheme MMTS-2) was due to have commenced storing water by the end of 2006. However, design work on the dam is yet to commence and the expected date of commissioning is now 2012 at the earliest. However, it must be stressed that even if commissioned in 2012, the proposed dam could play little part in a major drought until it has “warmed up” by substantially filling. Hence the period of severe risk of restrictions could extend well beyond 2012. In the interim the users face great risk of severe water restriction.

By the earliest date that the new scheme can be commissioned the Mgeni River system will have been in deficit for no less than 9 years. And even after commissioning of Spring Grove Dam the system will remain in deficit for a further 4 years until the end of 2017. DWAF’s response has been to request the implementation of laudable measures to reduce the demand by 16% through curbing water theft (8%) and replacing broken asbestos cement pipes (8%). Nevertheless, these initiatives are costly and time consuming (R850 million over 3 years to replace the pipes). Moreover, curbing water theft and wasteful practices will require political will and the employment of sufficient resources. Will this be forthcoming?

The long period of deficit (both planned and the unacceptable delay in meeting even these plans) points to severe disjoint between planning by DWAF, the LAs and the actual implementation. The question must also be addressed as why the 6-year (at least) delay in the commissioning of Spring Grove Dam has been allowed to happen? Clearly someone has lost sight of the ball.

All of this points to a national crisis unfolding before our eyes.

2.4 Water theft

A recent article on the Vaal River system published in the Water Wheel, based on the findings of recent studies revealed:

“... irrigation water use in the Vaal River System has increased by more than 100% between 1998 and 2005 for the area upstream of Vaal Dam alone.”

“Up to [185 revised figure] million m³/a of irrigation water use in the Upper Vaal WMA is estimated to be unlawful.”

“This has been a shocking discovery, and probably the main reason why the Vaal River System is currently in deficit.”

The Water Wheel May/June 2008

Hence, the addition of water theft means that the projected **deficit** in the Vaal River system by 2013 **is already a present reality**. This is a national crisis of the first order.

Presumably the theft of water can be remedied quickly, simply by bringing the offenders to book. However, should we face a major drought since the last filling of our major dams, then we enter that drought short of about 100 m³/a stored in our dams (assuming that the last filling occurred in May 2008), and this figure increases by another 1 million m³/a for every 1½ days that passes without effective action.

This points to the urgent need to take appropriate action to curb the theft of this costly resource.

It defies the imagination how the theft of 185 million m³/a could have gone undetected for so long. The same article states that the next water resource development phase (which will take at least another decade to develop) will deliver a further 15 m³/s (i.e. 473 million m³/a). This means that the current water theft in the Upper Vaal WMA alone is a whopping 39% of the entire delivery of the next major water augmentation scheme, or 33% of the current large interbasin transfer from the Tugela River via the Drakensberg scheme. How could DWAF operators and managers have missed such a large reduction in the amount of water reaching Vaal Dam? How could they have failed to notice the large upsurge in irrigation abstractions and area of land irrigated?

Unlike the preceding crises in which LAs played a significant role, this one arises purely from failure to monitor, interpret and control use of the resource. Clearly it speaks of crumbling capacity within DWAF. This is evidence of another national crisis of immense proportions unfolding before our eyes.

2.5 National Water Resource Strategy

It is a legal requirement for the Minister to produce a National Water Resources Strategy (NWRS) every 5 years. The serious failures enumerated above clearly demonstrate that this is not merely an academic requirement. It is essential to the well being of our country.

The NWRS must set out the key water challenges and proposed responses. The NWRS (2009/2014) is due out next year. There must be wide consultation before this is finalised. Where is it?

2.6 Summary

Essential water supply augmentation schemes for the water supply to both the largest and second largest conurbations in South Africa, which together account for most of the GNP of South Africa, at anywhere between 6 and 11 years late and are facing unacceptable risk of supply shortfall.

Theft of the water resource on a massive scale presents another major crisis.

Failure to implement water conservation and water demand management measures has played a major role in precipitating these crises. However, the crises also point to disturbing failures within DWAF that require urgent attention.

The tardy release for the NWRS is a symptom of the problem, but also played a significant role in precipitating it, since this should have provided the glue that joins the NWA and the WSA. Moreover, the NWRS should not be viewed merely as a 5-yearly chore to be published. At a departmental level its implementation should be continuously monitored and adapted as new facts emerge.

3. WATER QUALITY

The challenge is not just quantity. Water that is too polluted to use is as serious as no water at all. This is beginning to happen in some areas, to name but a few:

3.1 Pollution problems inhibiting water use

Vaal River Catchment

- Coal and industrial pollution impairs water quality in the Waterval River.
- Large pollution sources in the small but highly developed Barrage catchment cause severe salinity, eutrophication and biological pollution, which in turn lead to huge economic loss, necessitating blending and dilution operating rules that entail the discharge of additional water from Vaal Dam.
- NW Province and Welkom / Virginia gold mining decant (acid mine drainage) and sewage effluent in the Middle Vaal WMA creates similar problems.
- Salts are further concentrated in the Vaalharts irrigation scheme.
- Intensive irrigation in the Modder-Riet catchment reduces the large quantity of fresh water imported from the Orange River to a trickle of highly saline water entering Douglas Weir.
- Polluted water spilling from Douglas Weir contributes to the salinity of the downstream Orange River.

Crocodile West

- Much of the water resource of the upper Crocodile River catchment is derived from saline and nutrient enriched sewage effluent. This leads to salinity problems throughout the downstream river system and severe eutrophication of the major impoundments. That in Hartbeespoort Dam is so severe that it was rejected as a source of raw water for Rustenburg in favour of a pipeline all the way from Rand Water.
- This could also affect water supply to the old and planned new power stations in the Waterberg area.
- Severe eutrophication led to the cancellation of an international event at Roodeplaat Dam.

Mpumalanga

- Intensive coal mining in the upper Olifants River catchment has resulted in severe sulphate and salinity problems.
- Salinity levels in the remainder of the catchment are impaired by irrigation and mining in the Phalaborwa area.
- Pollution has also been linked to Crocodile kills in Loskop Dam and in the Kruger National Park.

Mgeni and Durban beaches

- Biological pollution is a serious health threat in the Mgeni catchment and at various beaches.

Atmospheric deposition

- The deposition of sulphate salts arising from emissions from power stations, Sasol and other industries has been recognised as a major long-term threat to the salinity and possibly the acidity of the water resources of the Upper Vaal catchment. The potential for these problems is viewed in so serious a light that it is a consideration in the siting of future major power stations and Eskom and Sasol are undertaking a major study of these impacts.

3.2 Biological health threat

The preceding pollution problems are serious enough to constitute crises in their own rights. However, the health threat posed by biological pollution is such an affront to the poor and indigent, who comprise so large a proportion of our population, that it warrants consideration on its own.

Hardly any portion of the country (except the least populated areas) is immune to health threats arising from biological contamination of essential water resources. The poorest communities are the most compromised. These communities also contain disproportionately high proportions of citizens whose health is compromised by HIV and Aids. Infants and children are also highly vulnerable, as witnessed by recent alarming press and TV reports. Outbreaks of diseases such as Cholera are also a serious threat.

Much of this problem is the direct result of the collapse of existing sanitation systems and difficulties encountered in the siting of informal settlements and the provision and maintenance of essential services. This is already a major crisis in rural communities. In some areas shortsighted planning has resulted in new bucket eradication schemes actually causing a sharp deterioration in service provision. For example, in some Freestate settlements replacement of bucket sanitation systems with ambitious sophisticated flush sewer systems has left residents with no sanitation at all since the water supply is insufficient to flush their toilets. In other instances the large increases in sewage inflow volume has led to overloading of inadequate sewage works and dangerous pollution of downstream river systems.

Larger metros are also showing strain, the main saving grace being the fact that these areas are largely provided with good potable water supplies and hence the poor generally do not need to drink the polluted river water.

The gravity of the situation is best illustrated by the following e-mail:

"I was at the Howick WWTW "outfall" into the Mngeni River today – looked like the effluent in an anaerobic digester – dark brown, thick and smelly. It flows through an informal settlement, which is about two paces away from the houses on either side of the torrent, which then disappears over the Krantz to meet the river after the scenic Howick Falls. I saw a child take a container and rinse it out in the "water". Absolutely horrific!"

Judy Bell, Environmental Consultant, 13 October 2008

The reality is that LAs in rural areas clearly lack the capacity to deal with these problems.

This is a national crisis.

3.3 Capacity constraints in DWAF

The few professional personnel in directorates and sub-directorates in the DWAF head office and in the regions are trying valiantly to deal with these multiple crises. However, many of the staff under them lack the necessary experience and are often too mobile to acquire the necessary skills. Moreover, the experienced personnel are stretched to the point of near ineffectiveness and cannot find the time to train the other staff members. Many of the water quality managers are so much in demand that appointments to see them have to be made one or even 1½ months in advance,

and often these are broken or cut short to deal with urgent matters, such as answering parliamentary questions.

Clearly these departments are critically under-resourced.

This is a national crisis that is no doubt significantly contributing to the preceding crises.

3.4 Waste Water Charges

The Waste Discharge Charge System (WDCS) is viewed as an important vehicle for alleviating some of the pollution problems and ensuring that the polluters are not allowed to continue externalising the costs of their production to the detriment of downstream users and the environment.

Why has the WDCS not yet been implemented?

4. AGEING INFRASTRUCTURE

Ageing infrastructure affects both LAs and the DWAF. These are discussed below.

4.1 Local Authorities

The collapse of water supply and sanitation infrastructure is well into crisis mode in rural areas. Although less obvious at present, larger metros and even Water Boards could soon face similar problems. This problem will not be discussed further here since it essentially falls under the WSA and is touched in other parts of this submission.

Suffice it to say that this a major national crisis of the highest order that is at least partially responsible for most of the crises that have been identified.

4.2 Dams, canals and pumps

The DWAF's Strategic Framework on Water for Sustainable Growth and Development discussion document (April 2008) cites numerous cases where major water resources infrastructure is in serious need of maintenance and refurbishment. This includes *"160 out of 294 dams owned and operated by the department (54%) require maintenance to meet current safety standards"* and 17 canal schemes that require major rehabilitation work.

Some of the pumps driving links of the water transfer schemes to strategic industries have also failed.

4.3 Information systems

To measure is to know. However, growing gaps are evident in both flow and water quality monitoring networks. The capacity to run associated information systems is also declining, with the result that threatening trends are not being identified, leading to inevitable consequences such as the undetected theft of water from the Liebenbergsvlei and other rivers in the Upper Vaal catchment. It is likely that there are other incipient or even long-standing problems that are as yet undetected due to inadequate monitoring and lack of resources and capacity to interpret the information and take appropriate remedial action.

4.4 Funding deficit

The Strategic Framework on Water for Sustainable Growth and Development discussion document indicates a gross under provision of expenditure for the maintenance of water services assets.

4.5 National Water Resources Infrastructure Agency (NWRIA)

The new NWRIA (yet to be operational) is envisaged to handle the financing, construction and management of major water resource works. Its establishment will see a phased integration of DWAF's National Water Resources Infrastructure (NWRI) branch and the Trans-Caledon Tunnel Authority (TCTA). The NWRIA will raise investment funds on the capital market, supplemented by the DWAF budget where extra costs are envisaged for 'social' requirements. The NWRIA was initially planned to be operational this year (2008) but it is nowhere near. Where is it?

5. CAPACITY AND SKILLS

The loss of capacity and skills is one of the main reasons why the NWA is not being implemented successfully.

5.1 Local Authorities

Over the last 14 years LAs have experienced a 7-fold loss of engineers and technologists. This has inevitably resulted in:

- The collapse of Infrastructure and maintenance programmes
- Widespread demand management failures
- Water treatment failure.

This is a major national crisis that threatens the life-blood of the country.

5.2 Middle management gap

Over a number of years a gap has been opening in the middle management ranks of the DWAF. This widening has accelerated and now extends into metros and Water Boards. These organisations have a core of experienced senior managers who are barely coping.

The problem originates from the inability to retain new staff inducted into then organisations. Recruitment of young professionals comes mainly from bursary students who leave the organisation soon after working off their bursary obligations, by which time they have barely begun to be effective even in the lower levels of the organisation. Few stay long enough to gain meaningful experience and advance through the organisation. This opens up a widening middle management gap that starves the organisation of skilled manpower. This has a negative feedback, since the few experienced managers who are left have less time to give the necessary training to their protégés. Most of these leave anyway, since the professional salary scales at the lower end of the organisation are hopelessly inadequate compared with what can be earned in the consulting and contracting fields, both of which are actively recruiting.

It is expected that many of the experienced senior managers would tend to stay with the Department longer than the junior recruits since they have better salaries, hold

responsible positions, derive a high level of job satisfaction, are dedicated to their work and tend to hold out for their retirement benefits. However, they are becoming increasingly stressed as the magnitude of the problems facing them magnify while at the same time their numbers diminish due to retirement and resignation. Pressure of work is also making them increasingly inaccessible, which carries inherent dangers.

We are concerned that on aggregate the relevant experience level in the DWAF is declining. Accordingly we are anxious to see a comparison between the aggregate experience (in man-years) within the Department now compared with that of five years ago?

Attempts to fill the management gap by rapidly advancing junior professionals meets with limited success since such leapfrogging deprives the young professional of essential experience, leaving them insecure and unable to function effectively. Even less successful are attempts to fill senior positions with inappropriately experienced importees from outside the organisation. Often the new appointees serve only to dilute the management structure, inhibit effective vertical communication and increase the burden on experienced managers who then have to attempt the near impossible task of training their new inexperienced colleagues. The appointment of inexperienced personnel over their heads and the blocking of advancement paths also increases frustration levels and has a demoralising effect. The better new managers recognise their limitations and lean heavily on their subordinates for advice thereby simply becoming additional overheads and might eventually gain a measure of competence, although important gaps in their experience can remain dormant and only come to the fore when important decisions have to be made or when important problems go unnoticed by default. The most dangerous problems arise when the new managers actually delude themselves into thinking that they know what is going on (an unfortunate trait of the young who get promoted too rapidly). Such managers can cause untold damage.

Unfortunately these attempts at filling management positions with inexperienced personnel do little to alleviate the middle management gap.

The growing middle management gap is responsible for precipitating many of the crises discussed in the preceding sections. This is a national crisis of the highest order that threatens to destroy the very fabric of fine organisations such as DWAF, Water Boards and major metros.

5.3 Education

The recruitment and education of engineers and water scientists has become a critical bottleneck that will seriously affect DWAF, LAs and Water Boards for many years to come. Figure 2 illustrates the pipeline leading to the development of competent, but still inexperienced engineers or water scientists.

All children are recruited into the education system. During the next 12 years these move through primary and secondary school education, the majority of whom leave to enter non-professional careers. Typically the upper 5% have the necessary intellectual skills to gain university entrance and master the complex mathematical and scientific competencies required to successfully enter an engineering or scientific career.

However, on gaining a university entrance certificate some 19 out of 20 matriculants find that they cannot enter an engineering or scientific career for the simple reason that they do not have sufficient competency in mathematics. The blockage occurs

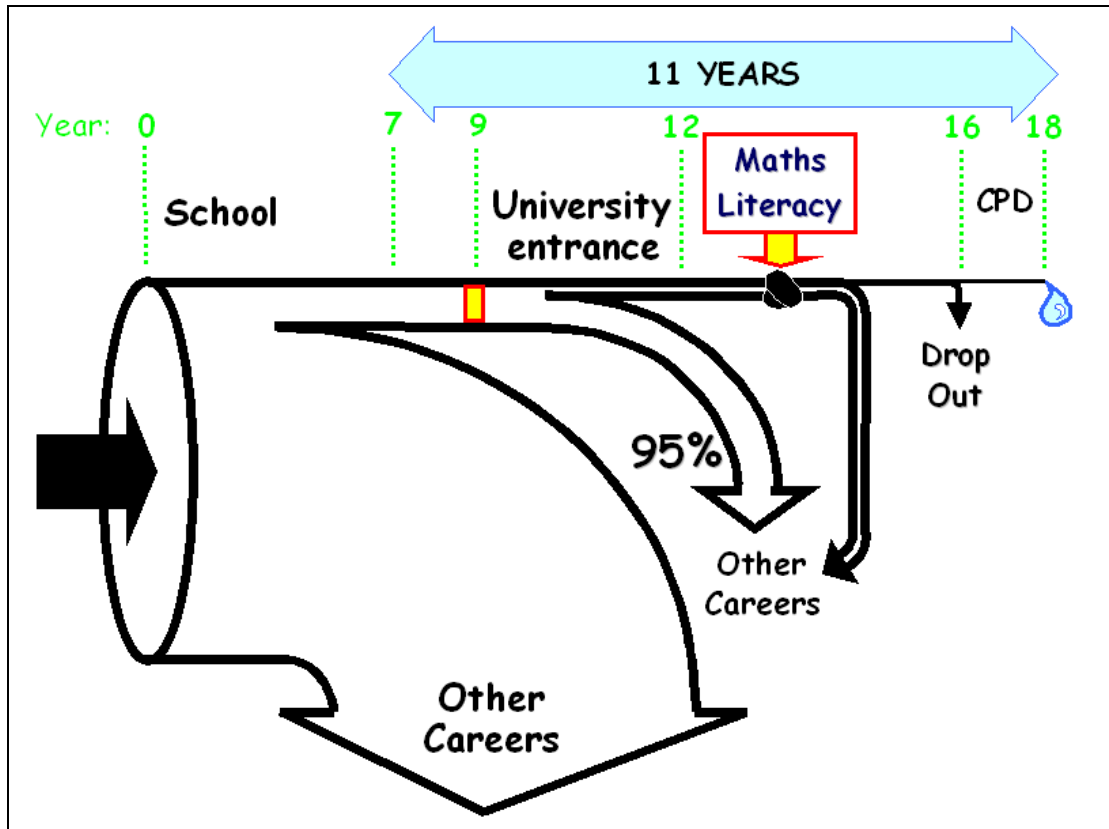


Figure 2: Water professional training pipeline

more than three years earlier when grade 9 learners are compelled to make their subject choices for the last three years of secondary school. More often than not they are badly advised to take maths literacy since it is much easier than core maths and they should therefore be able to get better matriculation grades. It is only three years later that they find numerous profession career paths closed to them, including medicine, accounting, economics, etc. Ironically one of the few university faculties that will accept their inadequate maths literacy qualification is that of education.

Aside for the allure of easy access to higher symbols, maths literacy is often promoted because of a lack of competent core maths teachers.

The previous government attempted to get the top 5% of the professionals out of only 10% of the population, which was a genetic impossibility. As a result of this deliberate policy there were only enough professionals to extend adequate services to only a small portion of the population. However, we now have the situation where all of our engineering and scientific professionals have to be drawn from only 5% of 5% of the population, which is only half of what we had before, whereas by now the Education Department has sufficient time to prepare 20 times as many. This has not been done intentionally for political gain. But the results are devastating.

On of the consequences is that the failure of the education system has set back the attainment of HDI goals among engineering and science professions by decades. The school system is starving universities of HDIs with the required skills to enter engineering and scientific faculties. It is not for want of ability. 95% of the talent is simply being lost to engineering and sciences – victims of maths literacy.

This is a national disaster of monumental proportions.

Obviously not all of the few university recruits with the necessary skills will enter engineering and science, and fewer still will lean towards the water field. Some will drop out of university, leaving only a trickle entering the water field.

Even if it takes only two years to revamp the maths education in our secondary schools, it will still take 11 years before the effect is felt at the end of the professional pipeline. (Five years in secondary school, four years at university and another two years of on the job professional training. And even then they would still have a long way to go in gaining experience.

6. CLIMATE CHANGE

Compared with the man-made crises that we are facing, climate change is still a much less imminent threat. However, the impact of global warming is predicted to be amplified in the water environment with greater variability reflected in bigger and more frequent floods and longer droughts. In addition, significant changes are expected in river flows. This will all increase the challenge of managing our precious water resources. The much bigger threats that have been pointed out will simply be overlaid with a higher risk of system failure and the need to plan that much more effectively.

Therefore, if we are concerned about managing the impacts of climate change and adapting to them, it is vitally important that we should strengthen, not weaken, our capacity to manage our water resources.

7. WHAT NEXT?

The following issues have to be addressed as matters of great national urgency:

7.1 Build capacity in Local Authorities

There is an urgent need to build capacity at every level in local authorities and ensure that the WDSPs are produced in time and that the water supply infrastructure is maintained and refurbished and that household water leakage and water theft is curbed. This will require active recruiting and substantial improvement in service conditions including attractive salaries and sufficient status to affect the decision making process.

7.2 Build capacity in DWAF

There is an urgent need to improve service conditions for professional engineers and scientists in DWAF to save the organisation from total loss of essential middle and top management skills. It is essential to make salary scales and attractive at every level, especially at the entry level. Clear growth paths need to be established for all competent personnel.

7.3 Strengthen link between water resource and water demand management

Foster effective linkage between the WDSPs and the NWRS to ensure the development of coordinated plans and effective implementation.

7.4 Flow monitoring and feedback

Rebuild the capacity to run and interpret flow monitoring systems to ensure that future theft of the resource is identified and dealt with timeously.

7.5 Establish Waste Discharge Charge System

The Waste Discharge Charge System should be established as soon as possible.

7.6 Implement effective sanitation

Every effort should be made to establish effective sanitation systems and to empower proper management.

7.7 Refurbish and maintain aging bulk water infrastructure

Programmes for the systematic maintenance of bulk water infrastructure should be established and the necessary funding secured.

7.8 Revamp maths and science education

Every effort should be made to impress on the Education Department the urgent need to overhaul maths education in secondary schools with a view to utilising the full potential of learners.

In view of the fact that capacity is currently in a critical condition and the length of time required to rebuild it, it is essential to use the human resources at our disposal to their fullest potential. The following actions are aimed at achieving this:

7.9 Open up and collaborate

DWAF is closed to consultation on key issues. The imperative for transparency cannot be over stated. The public has the right to know about the decisions that affect their and their children's future. Moreover, the private sector has a large reservoir of desperately needed professional expertise and technical skills that can and must be tapped to their full potential.

In this regard SAICE and WISA have taken several initiatives to assist and their members are ready to do much more. Initiatives already underway include:

- SAICE set up a Section 21 company devoted to addressing skills shortages, particularly in Local Authorities.
- The spirit of cooperation is evidenced by the fact that DWAF was a co-funder of the ENERGYS programme and they are currently funding several capacity building programmes through WISA and SAICE.
- SAICE pioneered a meeting of Tertiary Institutions to discuss bottlenecks and made representations to the Department of Education. The SAICE Section 21 Company was subsequently appointed by JPSA to submit a report and make recommendations on how to deal with this issue.

7.10 Prioritise

Given the capacity constraints, DWAF should focus on the priorities, not on "nice to haves".

7.11 Programme

The NWA does not require everything to be done at once.

7.12 Simplify

Some parts of the NWA and particularly the regulations are too complex and need to be simplified to be feasible and to avoid diverting scarce resources.

7.13 Partner

South Africa still has many highly regarded skills in the water sector. They must be harnessed and fully used.