Water Demand Management (WDM) – current water productivity methodology and water management tool in South Africa

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Abstract

Firstly, South Africa's water situation is discussed – i e its annual rainfall, evaporation and its classification according to international standards as a water-scarce country.

Subsequently, the need for water demand management in South Africa is demonstrated leading to the new policy of introducing water demand management as a water productivity methodology and water management tool in South Africa since 1994.

Interesting water demand management measures are consequently discussed in each of the following main water use sectors of South Africa : agriculture, municipal, industrial, mining, power generation and environmental. These measures can usually be implemented in the water use sectors of other water scarce or water stressed countries in Africa and elsewhere in the world.

Many water demand management measures are available in each of these major water use sectors and only a few innovative ones will be mentioned in each sector. Interesting ones include the following :

- *In agriculture: new irrigation methods such as the surge and the casing or sleeve irrigation methods, rainwater harvesting and landscaping methods such as contouring*
- *In the municipal sector: retrofitting and funnels or hosepipes at standpipes*
- *In the industrial sector: recycling, re-use and virtual water*
- *In the mining sector: using water from the dewatering of mines, using old mines as reservoirs and ensuring pollution control*
- *In the power generation sector: introducing alternative renewable energy sources and the retrofitting of electrical devices*
- *In the environmental sector: the eradication of water-thirsty vegetation ("Working for Water" programme), prevention of soil erosion and improving the network of measuring devices in South Africa to manage South Africa's water sources more efficiently*

The conclusion is drawn that if South Africa is to survive in the water field during this new century, water demand management will have to be researched and introduced much more vigorously in the country than in the past.

Key Words "Water Demand Management" "South Africa" agriculture municipal industrial mining "power generation" environmental

South Africa's water situation

South Africa is a water-scarce country according to international standards. The entire western part of the country (with the exception of the south western and southern coast-line) is classified as semi-desert. South Africa's average annual rainfall is about 500 millimetres in comparison with the world's average rainfall of about 860 millimetres per annum. South Africa therefore receives less than 60% of the world's average annual rainfall.

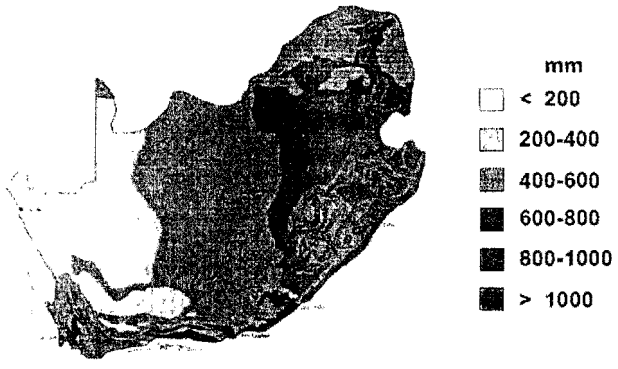

Figure 1. South Africa's average annual rainfall zones

Since South Africa is a country with lots of sunshine, its average annual evaporation is high – in the order of 2 000 millimetres per annum. South Africa's evaporation is thus four times more than its rainfall. For every drop of water the country receives, the country therefore loses four drops of water to the atmosphere! Furthermore, South Africa does not have any major lakes or rivers, nor does it have any significant groundwater sources.

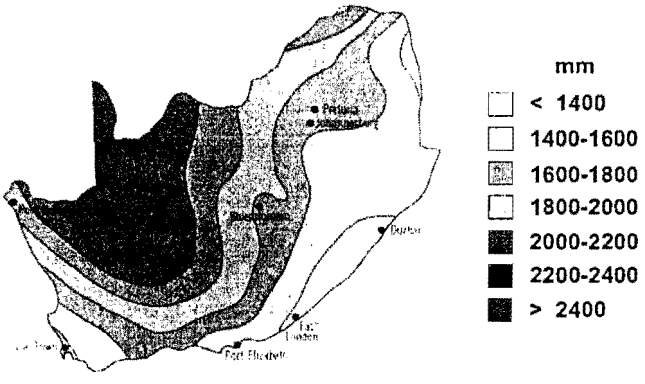

Figure 2. South Africa's average annual evaporation zones

Compared with the rest of the world, South Africa is the 27th driest country on earth out of a total of 194 officially recognised countries. The 26 countries being drier than South Africa, are situated mainly in the Middle East and in the Sahara Desert belt in North Africa.

Taking this precarious water situation into consideration, water demand management was introduced since 1994 as part of the current trend in water planning and efficient water management in South Africa.

Water demand management as a new water productivity methodology and water management tool in South Africa

Water demand management was introduced by way of the National Water Conservation Campaign just after the 1994 elections in South Africa. It consisted of 56 projects aimed at water demand management in all the major water use sectors of South Africa, namely the agricultural (irrigation), municipal, industrial, mining, power generation and environmental water use sectors.

The definition of water demand management which was adopted, was the following :

"Any action which reduces the demand for fresh water through the more efficient usage of water, thereby influencing the water balance to the benefit of mankind and life on earth."

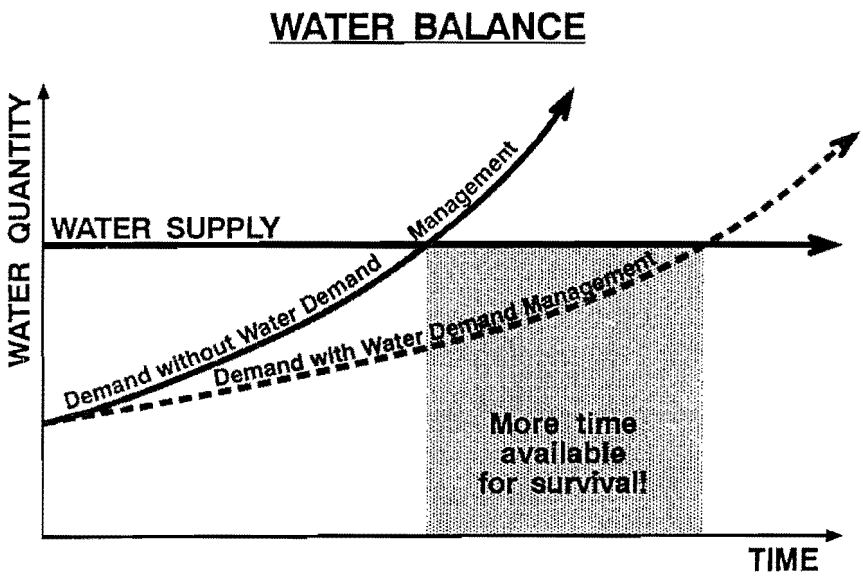

Figure 3. WDM and the Water Balance

The aim with the projects of the National Water Conservation Campaign was to follow a holistic approach according to international evidence that water demand management is most successful when economic, technological, communication and mandatory measures are applied simultaneously.

With the water demand management approach since 1994, water management in South Africa moved out of a period of isolation into the global water management arena. The National Water Conservation Campaign has been internalised into the Department of Water Affairs and Forestry in South Africa in 1998 and water demand management forms an important current methodology and water management tool in South Africa, as is evident from the new National Water Resource Strategy which was published in 2004.

Interesting contemporary water demand management measures in the agricultural (irrigation) sector

The agricultural sector is still the biggest water use sector in South Africa with nearly half of South Africa's water going to this sector. Water demand management in this sector is therefore very important.

There are numerous water demand management measures in agriculture – many revolving around water loss control, tariff structures and actual water metering. Irrigation methods are also under constant scrutiny. Two interesting new irrigation methods which could be regarded as water demand management measures, are the so-called surge and casing irrigation methods. With the surge method water is pushed in a small number of gushes into

irrigation beds thereby reducing evaporation during long irrigation application periods. This is of particular importance to South Africa with its high annual evaporation figure. The casing or sleeve irrigation method channels water by way of casings or sleeves down to the root zones of crops where the water is actually needed and absorbed by plants.

Other interesting water demand management measures in the agricultural sector include scientific scheduling with modern technology, agro-sanitation, the choice of irrigation crops and the eradication of unwanted water thirsty plants (the so-called "Working for Water" programme).

Landscaping such as contouring, does not only reduce soil erosion, but also saves water by keeping more water on the agricultural lands. It also reduces the sedimentation of South Africa's dams and the washing away of precious topsoil.

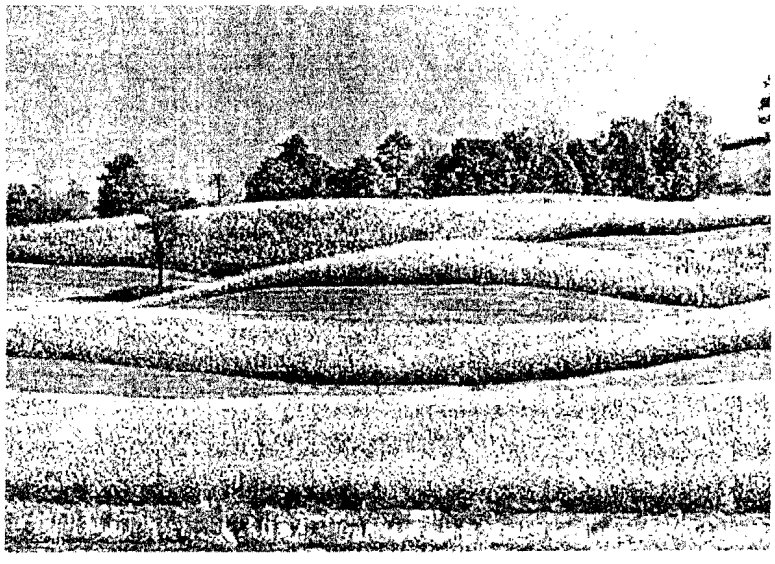

Figure 4. Landscaping and contouring reduce water loss in agriculture

Rainwater harvesting is a water demand management measure which attracts much interest among the public in South Africa currently. By building small walls and sealing off catchments, the run-off of larger areas (say 20 hectares) can be concentrated to small plots of only one hectare and sustainable crop production can be maintained in areas with annual rainfall figures of as low as 100 to 200 millimetres. This technique is already implemented successfully in the Middle East today and it yields sustainable harvests.

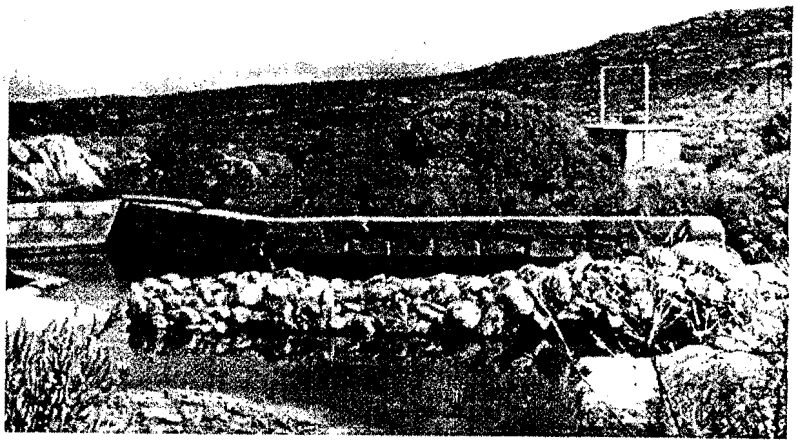

Figure 5. Rainwater harvesting is a water demand management measure in agriculture

Interesting contemporary water demand management measures in the municipal sector

In the municipal – and particularly the domestic water use sector – many interesting water demand measures exist. Domestic water tariff measures are quite general with increasing block water tariffs usually being quite effective. The installation of water meters and the detection of water leaks usually also yield good results. Water-wise gardening can contribute much to water savings around the home.

The retrofitting of plumbing devices is a relatively new type of water demand management measure which has only been introduced more generally in South Africa during the post-apartheid era. This entailed dual flush toilets, low flow showerheads, aerated taps and the replacement of automatic flushing urinals by manually controlled ones.

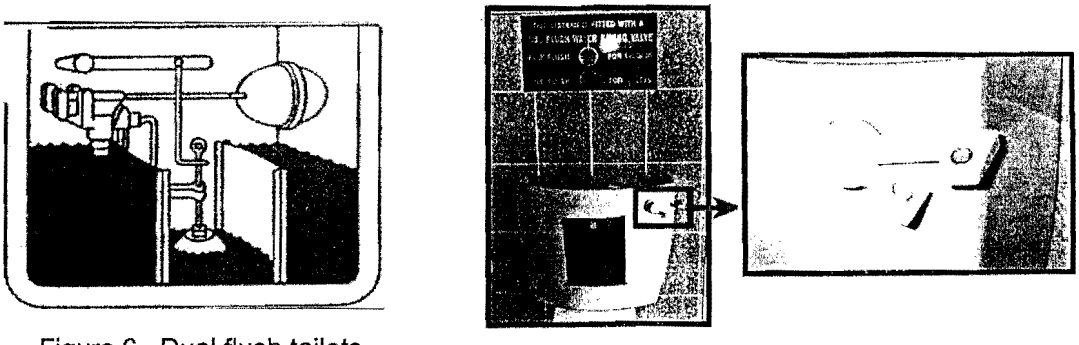

Figure 6. Dual flush toilets

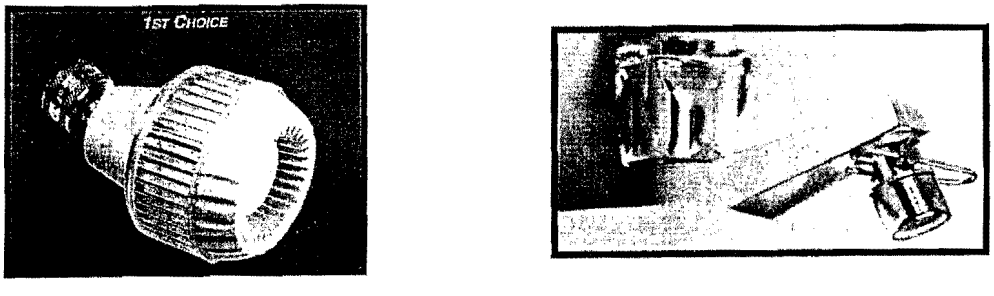

Figure 7. Low flow showerheads and aerated taps

In the case of developing communities in townships, large quantities of water can be saved if funnels or hosepipes are used at standpipes. Roof tanks also proved to be essential in especially the drier parts of South Africa where they often provide water for survival.

Figure 8. Considerable quantities of water are often wasted at standpipes in townships

In the domestic water use sector, communication strategies have been found to be important water demand management measures. Since 1994, these strategies were aimed at cultivating a culture of payment for water services and making the population aware of the preciousness of fresh water in South Africa.

Interesting contemporary water demand management measures in the industrial sector

Besides water tariff measures which include water metering and pollution control mechanisms such as the "polluter pays" principle, many other water demand measures exist in the industrial water use sector. The recycling and re-use of water are important water demand management measures in the industrial sector. The aim is to recycle water several times (up to sixty times in the USA) before new water is added or the water is replaced.

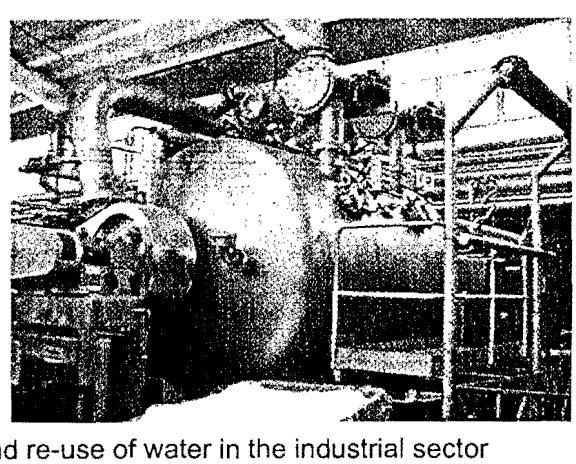

Figure 9. Recycling and re-use of water in the industrial sector

Virtual water is another interesting water demand management measure which takes into account the water imbedded in the products during their manufacturing. It is therefore water which one cannot see (virtual water). By importing 1000 tons of paper, for instance, you also

import 700 000 tons of water which is saved and which can be used for other purposes in the recipient country.

Interesting contemporary water demand management measures in the mining sector

Whereas the previous water legislation prohibited the use of water coming from the dewatering of mines in South Africa, this source of water will have to be investigated more closely as the country's water situation becomes more volatile. Pollution control based on the "polluter pays" principle is also very important in the mining water sector.

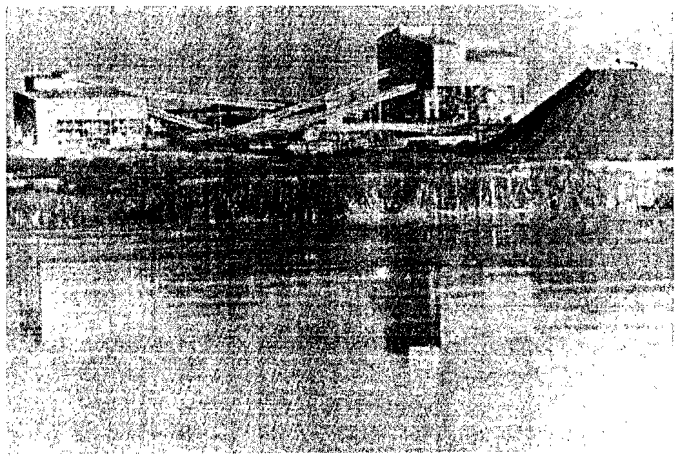

Figure 10. Water from the dewatering of mines could be applied in future

Taking South Africa's high annual evaporation figure into account, the storing of water in old mines may prove a possibility if water leakages and dangerous pollution factors (arsenic substances are used in some of South Africa's gold mines) can be curbed.

Interesting contemporary water demand management measures in the power generation sector

In South Africa about two litres of water are used to generate one kilowatt of electricity at the coal-fired power stations, which provide more than 90% of the country's electricity supply. This means that a 100 Watt globe uses two litres of water over a period of just ten hours. It also means that forty litres of water are used during the same period by a two kilowatt heater! Using alternative renewable energy sources such as solar, wind or tidal energy in South Africa will therefore save considerable quantities of water. Also, if electricity can be saved in South Africa by retrofitting electrical devices in homes, much water can be saved.

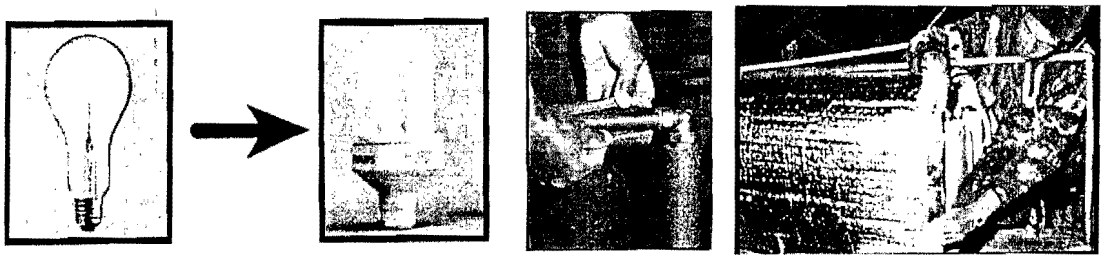

Figure 11. The retrofitting of electrical devices is a water demand management measure

Interesting contemporary water demand management measures in the environmental water use sector

The eradication of alien and other unwanted water-thirsty vegetation in the environment through the "Working for Water" programme has proven to save approximately 25% to 30% of the run off in catchments in South Africa.

Figure 12. The "Working for Water" programme saves water in the environment

The prevention of soil erosion through contouring and other landscaping methods, does not only retain water in the environment, but it also prevents valuable topsoil being washed out to the sea and dams being silted up far more speedily.

Improving the network of measuring devices such as weirs and other flow metering instruments in South African rivers, is deemed necessary to save water in the country. The improvement of these systems is therefore also regarded as a water demand management measure. Only if water sources and water systems are well measured and reliable quantified information is produced through well maintained water measuring systems, can water management and water savings be optimised – not only in South Africa but also in the rest of Africa and elsewhere in the world.

Conclusion

The conclusion is drawn that water demand management is very important for South Africa to survive in the water field during the twenty first century. Water demand management will consequently have to be researched and implemented far more vigorously in South Africa if the country is to cope with its water requirements during the new century.

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Management of the Water Resources of South Africa – official publication of the Department of Water Affairs, Pretoria, South Africa, 1986.

Several brochures and reports of the National Water Conservation Campaign of the Department of Water Affairs and Forestry in South Africa of which the author was the project manager during the years 1995 -1997.