Executive Summary

This report is the result of a project carried out to explore the status of water efficient devices in the domestic and commercial environments in South Africa. For the purposes of this study commercial environments were limited to public institutions such as schools, prisons and hospitals as well as shopping complexes and the hospitality industry. This report does not include information on the use of water efficient devices in industrial settings.

A water efficient device is one that serves the same function as its standard alternative, without any reduction in performance, while using less water. Traditionally the design considerations for toilets, showers, washing machines, basins, baths and taps have been functionality, aesthetics and cost. Not much attention was given to how much water these items used, because in many of the countries of manufacture water was always thought of as a cheap and abundant resource. However, the world's population has increased fourfold in the last century, and will at least double in the century to come. Along with this increase in population has been the emergence of megacities, sprawling densely populated conurbations with populations numbering in the tens of millions (e.g. Gauteng, with a population approaching 11 million and, at the present growth rate, set to reach 20 million by 2025). With these changes, the adequacy of water resources in many countries has become a matter of critical concern. According to the United Nations Environment Programme, one third of the world's population already lives in conditions of water stress, and this proportion can be expected to double within the next twenty five years. Water can no longer be used with abandon, but increasingly needs to be used appropriately, and efficiently.

A water supply authority, looking to conserve water and manage demand, needs a holistic plan with four main elements, which are in nature

- Structural
- Operational
- Economic and
- Socio-political.

The *socio-political* part of the campaign requires advertising in all forms of the media, as well as the revision of laws and regulations. Without these "push" factors the market will not by itself move buyers in the direction of water efficiency. Authorities use *economic* methods, comprising pricing changes and penalties, to ensure that marginal water use is given its real marginal value. In South Africa municipalities combine free basic supplies to the poor with stepped tariffs to

ensure that those who choose to use above average amounts of water do pay for the privilege. *Operational* methods include the reduction of supply pressures (which in South Africa are often far higher than the 1 to 4 bar needed for domestic use) and the detection and repair of leaks. *Structural* methods include the fitting of on-site pressure reduction devices, the use of efficient irrigation systems, the use of recycling systems, and the use of water efficient devices.

There are many examples of water demand management and water conservation campaigns that have been implemented around the world. The city of Seattle in the United States, for example, has reduced its water consumption by 1% each year over the last 23 years despite a 23% increase in its population. In Southern Africa the city of Windhoek has managed to reduce average consumption from 320 litres per person per day to 220 litres per person per day over the last thirty years, in the process pioneering many of the demand management strategies that others are now emulating. In South Africa water conservation programmes carried out in the various municipalities supplied by Rand Water, the largest bulk water utility in Africa, have seen the annual growth rate in the water supply into that region reduce from 3.3% to 0% over the last three years, despite a concurrent 3.3% population growth rate. Cape Town, which has been through several years of water stress in the last seven years, has developed a holistic water conservation strategy, which includes the promulgation of the most comprehensive water conservation bylaws in South Africa.

In one sense it is against a municipality's interests to persuade its customers to use water efficiently and to penalise them financially for high water use, as water sales are a prime source of income for local government structures (in urban areas). However, if water is not used conservatively resulting in demand outstripping supply, then the municipality will end up having to pay for expensive infrastructure to augment its bulk water supply, which augmentation will cost in the billions of Rands for our larger cities. If a large water supply augmentation project can be delayed by five or ten years due to the introduction of good water conservation practice, the capital saving in present day terms will run into hundreds of millions of Rands.

The status and use of water efficient devices in South Africa – survey results

This study included four different surveys in order to gauge the status and use of water efficient devices in South Africa. Firstly, commercial and institutional settings such as hotels and hostels were investigated; secondly the suppliers of plumbing fittings were studied; thirdly the architectural profession was surveyed; and finally the knowledge and attitude of 1 428 home owners in 10 towns and cities in South Africa were tested.

Water Efficient Devices in commercial and institutional settings

In commercial and institutional settings, there is clear evidence that water efficient devices are becoming more common. From the City of Cape Town's programme to replace all the automatic flushing urinals in public buildings and install Hippo Bag displacement devices in all the old large capacity school toilet cisterns, to the sophisticated infrared operated taps and urinals that are becoming standard at airports, there is a move towards water saving and water efficiency. The larger hotel groups are signing onto environmental programmes, of which one component is sustainable water use, and there are encouraging examples where universities and other public buildings are being retrofitted with water saving cisterns, taps and showers.

Water Efficient Devices in the plumbing supply industry

The increasing market share of water efficient devices is apparent on the showroom floors of the major plumbing suppliers. This is almost in spite of the suppliers who, as a rule, do not push water efficiency (as one said, it is not their job to preach to their customers, who buy mainly on functionality, style and cost). The reason aerated taps, dual flush toilets, water efficient baths, basins and showers are increasingly been sold, is that these are becoming the standard in the countries of manufacture in Europe and the East. While South Africans are sometimes still wary of six litre flush toilets ("will they work?"), these, or even more efficient designs, are now the standard in parts of the USA, the UK and Europe.

Water Efficient Devices as regarded by the building profession

The building profession (architects, quantity surveyors and builders) is conservative by nature. No professional can afford comebacks from aggrieved customers who do not want to be used as guinea pigs for new inventions, and therefore there is a strong tendency to stick to the tried and tested. There is some evidence that architects are moving towards an awareness of sustainable water use. However, as one said in his response to the survey, they work to the building code, and if they are expected to change the way they work, then the building code should be changed.

Water Efficient Devices as understood by the general public

Of the 1 428 homeowners surveyed, 29% indicated that they had at least one water efficient device in the home. Typically only about 20% of the respondents in the average town believed they might possibly use too much water, but significantly more (40% to 50%) have considered reducing their water consumption. The factors which *prevent* people from installing water efficient devices include the following:

- they do not know of water efficient devices

- they do not own their own home (i.e. they are renting)
- they can't afford to make changes
- they do not see the need to make any changes
- they are too old to make any changes

Conversely the conditions which would persuade people to move to water efficient devices include the following:

- an increase in the price of water
- if rebates were offered for the installation of water efficient devices
- if there were water restrictions
- if they had a better understanding of water efficient devices, and
- if the use of hosepipes was banned.

South African municipal bylaws and Water Efficient Devices

A further part of this study was an investigation into the bylaws of South Africa's major towns and cities in so far as water demand management is concerned. It was found that while some (e.g. Cape Town and Ekurhuleni) give limits for cistern volumes and shower flows, outlaw automatic flushing urinals and are generally up to date regarding water conservation, others are silent or almost silent on the subject. In reality it is highly unlikely that municipal building inspectors have time to adequately police these provisions, especially when the neighbouring municipalities have bylaws which are not in line with theirs (e.g. Johannesburg and Ekurhuleni). Leadership at the national level is required to update the building code to comply with the more progressive water conservation bylaws. Once this is done, then architects, specifiers and builders nationally could all work to the same rules without having to know the details of the bylaws in every one of South Africa's 169 Water Supply Authority areas. If such a step could be taken, then the considerable sophistication and power of the existing building materials databases such as *Autospec* could relatively easily be harnessed to enable specifiers to find water efficient products (as defined by the codes), and for suppliers of those products to bring them to the attention of their potential customers.

The economics of fitting or retrofitting Water Efficient Devices

The economics of retrofitting water efficient devices to *existing* housing stock is very variable, depending on the device and the setting in question. It is relatively inexpensive and easy to swop out shower fittings (in much the same way Eskom has recently being going from house to

house and swopping out energy efficient light bulbs for the older incandescent bulbs), and these will typically pay for themselves in water savings within a few years. The economics of changing out toilet cisterns and pans is rather less attractive, unless they are in a setting where they are used by more users than would be found in the average family home. For this reason large scale changes to the existing housing stock are unlikely, and therefore the penetration of water efficient devices into the South African domestic market is going to be slow and gradual, probably taking a few generations to become the norm.

Recommendations for increasing the status and use of water efficient devices

In order for South Africa to move more swiftly and effectively towards the entrenchment of water efficiency, the following actions are recommended:

- **Government must lead by example**

  Some of the worst offenders for high water usage are government buildings. The state landlord, the Department of Public Works, should embark on an audit of water usage and the presence of water efficient devices in all buildings under their care. This would have an impact firstly on the entire civil service, which employs over a million people[1], but secondly it would impact on the population at large, who would see the state leading by example. The state is also able to take a longer view on the economics of retrofitting water efficient devices than is the average citizen, having access to cheaper capital.

- **South Africa needs a labelling system for Water Efficient Devices**

  South Africa should emulate the water efficiency labelling systems practiced in other countries, of which the most advanced appears to be the Australian WELS label. This label is not just a general "green" label, but includes product specific information and a graded rating from 0 to 6 stars. If such labelling eventually becomes mandatory in South Africa, it will affect the whole supply chain from manufacture, to marketing, to purchasing. This will help not only the public, but also the building trade professionals, from plumbers, to builders, architects and quantity surveyors to become more knowledgeable about water efficiency.

- **South Africa needs a nationally sponsored public education campaign regarding Water Efficient Devices**

[1] The figure derived from the February 2006 Public Service Commission document entitled "An audit of affirmative action in the public service" is 996 734, but this excludes the departments of Defence and Safety and Security. It also excludes all municipal employees.

Apart from product specific labelling, the state needs to make a case for water saving with the public. This campaign should appeal both to the public's sense of civic duty ("it's the right thing to do"), while not underestimating their intelligence (answering questions like, "why don't we just build bigger dams?", and "If I am prepared to pay for what I use why can't I use as much as I want?").

- **Information on Water Efficient Devices must be easily obtainable**

The public and even the building industry is still relatively ill-informed about water efficient devices. Water conservation in the built environment should be taught at undergraduate level to architects, and at FET colleges to plumbers. Water saving tips should be regularly distributed with municipal accounts, and should be displayed in appropriate locations. A website with product information, educational material and links to other useful sites offers great potential as a tool to promote water efficiency, provided it can be maintained and updated. The existing online product databases used by the building industry (e.g. *Autospec* and *Specifile*) can relatively easily be made to respond to searches for information on water efficient products, but this can not be done until there is a nationally agreed standard for such devices.

- **Municipal bylaws must include provisions relating to water efficiency and water conservation, and ideally there should be convergence across municipalities**

Of South Africa's 283 municipalities[2], 169 are Water Services Authorities (WSAs), in other words, they have responsibility for the planning and regulation of all water supply in their area of jurisdiction. If the rate at which water is being used in their area is becoming unsustainable, then it is their responsibility to either increase the supply or decrease the demand. One measure at their disposal for decreasing demand is the promulgation of bylaws that promote water conservation. Some of South Africa's bigger municipalities have recently updated their water bylaws, and some of these, such as Ekurhuleni, Cape Town and Tshwane have included sections on water efficiency. It would help if there was more consensus between municipalities on water bylaws, particularly in the case of a large conurbation such as Gauteng which spans several municipal jurisdictions.

- **Building codes and bylaws must converge**

Bylaws relating to behavior such as the use of hosepipes for washing paved surfaces (at any time) or for washing cars or watering gardens in times of water restrictions can be enforced. However, bylaws relating to the types or showers, baths and toilets installed in houses are

[2] Made up of 6 Metropolitan Municipalities, 46 District Municipalities and 231 Local Municipalities.

really only enforceable for new housing stock, and even then it seems unlikely that municipalities have enough building inspectors to do this work adequately. It would be far simpler to inspect at the source, i.e. to control what products are sold by the plumbing suppliers. The supply cannot be controlled as long as there is wide variation in water bylaws, and, moreover, divergence between water bylaws and the building code. The first and most important step would be to add a section to the building code bringing it into line with modern water efficient good practice. If this was done, then the suppliers and specifiers would be able to follow without worrying that they are out of line with standard practice.

- **Retrofit programmes with rebates (where appropriate) should be encouraged**

In South Africa there are many millions of poor people who are not required to pay for their water supply. While the official policy guideline is that each family should get a lifeline amount of water of 6 kilolitres free, in some urban areas the reality is that no water is paid for. For people in these areas there is no incentive to conserve water. In such areas, it may pay a municipality to intervene with schemes to retrofit water efficient devices, even if the full cost were to be borne by the municipality.

- **Water supply pressures must be decreased**

Water supply pressures in South Africa are, in general, far above international norms. No more than four bars of pressure is needed for domestic water supply, and municipalities would save both themselves and their customers money if they took steps to regulate the pressure in their systems down to this level. Owners of buildings in high supply pressure zones would save themselves wear and tear on their plumbing fittings, and would save water, if they installed pressure reducing valves on their properties that brought their pressure down to under the four bar level.

- **Informative Billing**

Even educated consumers take little time to attempt to understand or analyse their utility bills, which typically combine water, electricity, refuse removal and sewage charges. For less literate consumers the bills are daunting, to say the least. With modern technology, it is however quite possible to include simple graphic information, like a graph showing how water consumption has varied month on month for the last twelve months. With such easy to read, visual information, consumers can be more easily alerted to leaks or wastage on their properties.

SUMMARY TABLE FOR RECOMMENDED WATER EFFICIENT MEASURES

The table on the next page has been drawn up after reviewing what is available in South Africa and standards elsewhere in the world. This is a draft table which would require discussion between plumbing industry stakeholders and government before ratification. If ratified, the table could form the basis for an amendment to SANS 0400, the *National Building Regulations*.

Item Description	Specification regarding water efficiency	Notes
Cistern and pan – single flush	No cistern and pan for a new building should require more than 9 litres to clear.	More efficient systems requiring 6 litres or less should be encouraged using a labelling system.
Cistern and pan – dual flush	No cistern and pan with a dual flush mechanism should require more than 6 litres to clear on the full flush setting	
Cistern and pan – Interruptible flush	Cisterns and pans with interruptible flush mechanisms are an acceptable alternative to low flush and dual flush options.	The pan should be able to clear with not more than nine litres.
Shower	Shower roses should not deliver more than 18 litres per second at 4 bars pressure.	Showers should be aerated to improve efficiency. More efficient showers delivering 10 litres or less should be encouraged using a labelling system.
Bath	Baths should not hold more than 250 litres to the *overflow* level.	More efficient bath designs should be encouraged using a labelling system.
Basin	Washroom – limit to 5 litres Bathroom – limit to 10 litres Kitchen – limit to 20 litres	More efficient basin and sink designs should be encouraged using a labelling system.
Urinal	Automatic flushing urinals should be illegal. Urinal flushing should be user activated (either manually or with sensors), and should use no more than 2 litres of water per flush.	
Tap – bath	Flows should not exceed 10 litres per minute for single taps and 18 litres per minute for mixer taps at 4 bars pressure.	
Tap – basin	Flows should not exceed 6 litres per minute for single taps and 10 litres per minute for mixer taps at 4 bars pressure. Taps over basins without plugs should not exceed 4 litres per minute flow.	Tap flows should be aerated
Tap – external	Flows should not exceed 20 litres per minute at 4 bars pressure.	Taps located in public places which are not used for irrigation should be self closing after a set time has passed or volume of water has been delivered, according to context.
Hosepipe	Use of hosepipes for washing paved surfaces should be illegal. Hosepipes should be fitted with shut-off valves at the user end.	
Irrigation system	Garden irrigation systems should be switched off using timers and/or soil moisture gauges.	
Pressure reduction	Domestic water pressure should be limited to 4 bars and hot and cold water pressures must be balanced.	
Waterless toilets	Information regarding well tested designs of waterless toilet should be made available and these should be allowed for within the building codes.	
Waterless urinals	Information regarding well tested designs of waterless urinal should be made available and these should be allowed for within the building codes.	
Water Efficient Dishwashers	More efficient models should be promoted through use of labelling.	
Water Efficient Washing Machines	More water efficient models should be encouraged through use of labelling.	
Greywater recycling systems	National standards for domestic greywater recycling systems should be developed and certified designs should be promoted.	