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Human behaviour everywhere has had an impact on the quality and quantity of our planet's water. Water issues now threaten the quality of our lives. We see TV images of drought where rains fail, wells dry up, crops wither and die, lands erode and soil blows away, while European countries experience unprecedented flooding.

More and more rivers – major rivers – are used up before they reach the sea. Water tables drop; aquifers shrink; oncefertile lands are ruined by salt. We know that climate change will probably worsen a lot of these phenomena.

And we know that somehow connected to this is the daily reality of 6,000 water-related deaths, twoand- a-half billion people suffering the indignities of being without sanitation facilities and fully half that number suffering the health and livelihood effects of not having access to clean water.

We also know that worse is yet to come: water use has sextupled as population has doubled since the 1960s (ie, added 3 billion); what will be the situation in 2050 when we have added the next 2-3 billion? Sextupling isn't possible – we're already over the half-way mark in using the water available to us.

Can water efficiency, a seemingly pretty bureaucratic concept, be part of the solution? And can the use of an 'integrated water resource management' (IWRM) approach, often seen as even more bureaucratic than the water efficiency concept, be useful to anyone other than water theoreticians?

Probably: there is a growing acceptance of the main principles of better water efficiency and better water management which are set out below – along with some 'checklists' that indicate real life examples of the change that is essential and possible but not necessarily easy.

Water and life are indivisible, but water management and efficiency have at least two parts.

We use the term ‘water’ very casually – so let’s clarify some concepts first.

Water resources comprise the totality of rainfall, rivers, lakes, ice, aquifers and groundwater. These resources are central to food security, to the health of the environment, to our enjoyment of nature, to energy production, to transport – and often to our national concepts of ourselves. Water resources are managed, or should be, by public policy: by finance and trade ministers through tariff policies, by natural resource ministries and agricultural ministries, by allocation decisions and environmental regulations such as the European Framework Directive and the Chinese Water Law, by resource inventories, surveys and monitoring, and by trying to integrate the various uses made of water by various parts of society. Determinants of who gets what relate to the relative political power of the agricultural sector, the mining sector, the energy producers and the environmentalists.

Many of the UN’s Millennium Development Goals (MDGs) – reduced malnutrition, decreasing the number of those in poverty, improving the environment – will not be reached without improved water resource management. The Global Water Partnership, of which I am chair, provides a global support network for those working within countries and regions to change water resource use and promote better resource management.

Secondly, the aspect of water that is most immediate to each of us every day is water supply, or drinking water supply, which takes up a small part of water use, generally about 7% or 8% on a global basis. Water supply, often with sanitation and water treatment, is managed by municipal managers, water engineers and sanitation specialists.

Whether the citizens of a country have adequate drinking water is much more closely related to income level than simple water availability.

The decision about who gets water supply or who gets sanitation are primarily about financial and policy priority decisions and community organisation. A country that accords little real priority to poverty reduction is unlikely to deliver water to its poorest.

There is a lot of international attention here, too: in fact, more attention is given to drinking water than to water resource issues – and even less is given to sanitation.

The water Millennium Development Goals pledge to reduce by half by 2015 the proportion of people who do not have access to safe water. The Johannesburg Earth Summit added a similar target for sanitation. Those goals imply ambitious if not impossible enterprise.

Some countries – China, India, South Africa – are on track to meet those goals; in the poorest, it is not going to happen under anything like current conditions. And most of the other MDGs – child survival, girls' education, slum improvement – depend on progress in drinking water supply and sanitation.

For both kinds of water the impact on people's lives and livelihoods depends on who they are and where they are. Poor farmers are disproportionately found in rain-fed areas or at the tail end of irrigation systems. Fish is a principle protein source for the poor; water quality and quantity menace about 25% of current freshwater fish.

It would be difficult to exaggerate the extent to which poor people suffer from the impacts of dangerous or low water quality and quantity. They suffer in particular from inefficient, absent or malfunctioning municipal services. Close to half the population of the developing world suffering at any one time suffer from diarrhoea, ascarids, guinea worm, hookworm, and shistosomiasis (a welldesigned water system reduces the incidence of shistosomiasis by close to 80%). About 73 million working days are lost in India to problems associated with poor water quality and the health impact, with $600m lost in paying treatment costs and in the cost of lost production. A staggering 40 billion working hours are lost in Africa to carrying water.

This is women's work and if women cannot do it their daughters will come out of school and fetch water.

Adding in the efficiency dimension

Water efficiency is about making the best possible use of water and not wasting it.

The Johannesburg Earth Summit passed a specific directive calling on all countries, rich and poor, water scarce and water plentiful, to develop IWRM and water efficiency plans by 2005. The drafters specified the need for greater water efficiency in both water resources and drinking water supply, implicitly recognising the two distinct issues.

At Johannesburg, the world agreed to take measures "…to improve the efficiency of water infrastructure to reduce losses and increase recycling of water…" and "…to improve the efficient use of water resources and promote their allocation among competing uses." These are two rather different aspects of 'efficiency': the first dealing with the 'technical water efficiency' of water infrastructure works and the second with overall water use – which is very much the purview of IWRM.

Both forms of 'efficiency' are integral parts of the IWRM and water efficiency plans called for in the declaration.

Municipalities, drinking water and a more water-efficient future For drinking water, especially that delivered by municipalities, efficiency – reducing loss and promoting recycling – is about applying the most appropriate technology for the circumstances and incomes of the area, and doing enough maintenance and upkeep to keep leakage levels down. Among major cities, Edmonton and Singapore are usually cited as the only major conurbations with UAW (unaccounted-for water or, broadly speaking, leakage) levels below 10%.

Too often the levels range between 30% and 50%, or more. The culprit is usually money, or the absence of it. Where water service fees are too low, or where the utility cannot collect or keep the revenues for maintenance and expansion, the system suffers. In poor countries the poor suffer disproportionately, as they generally pay more for less water than they would if connected to the municipal utility. And when the situation is addressed by damning another river to build a reservoir that could have been avoided had greater efficiency been achieved through fixing leakage levels, the environment suffers.

The promise of new and newly-rediscovered techniques relating to water management and drinking water supply also offers ways to squeeze more use from each drop.

The last and most important issue is demand management. Anywhere there is metering, demand drops. In California, the Pacific Institute's Waste Not, Want Not campaign estimates that up to one-third of California's current urban water use can be saved using existing technology. And at least 85% of that saving can be saved at costs below what it will cost to tap into new sources of supply and without the social, environmental, and economic impacts that any major water project will bring.

There is much scope for improved drinking water supply and sanitation inefficiencies.

Here are some examples taken from Mexico, but quite universal:

Mexico is chronically short of water, but the average per-person daily consumption in Mexico City is double that of Berlin.

Again in Mexico one-third of municipal water is lost to leaking pipes and faulty systems. The city is sinking and a lake is being drained to feed the inefficient system.

Only 70% get bills and only half that number pays them, so there are no funds to pay for the repairs to pipes and systems.

Water efficiency and storage

Let us turn to water resource issues and start with storage. If 90% or more of the annual water supply falls in a period of days, it has to be stored to be usable throughout the year. The time-honoured solution to getting more water has been pretty much to increase supply, ie build dams, extend the pipelines and pump more out of the aquifer. China is busy moving part of the Yangtze River to the north, and India is talking very seriously about joining its rivers in a national grid. The Red-Dead Sea Connector talks go on throughout the Middle East problems.

It's too easy to be dismissive about this reality. Especially where there is little or no water

infrastructure, investment adds to water efficiency; and if we don't build it, often we are perpetuating poverty.

Australia and Ethiopia and Western USA all have about the same rainfall and climate, but where the USA and Australia have around 5,000m3 per head of water storage capacity, Ethiopia has only 50m3, and Africa and the Middle East as a whole only 1,000m3. Each USA citizen has fully 100 times as much stored for him or her vis a vis each Ethiopian. So how can Ethiopia grow more food and offer conditions under which industry might be established and meet people's needs for water?

Agriculture – or where is the water for the food for the future?

The biggest water user, the greatest concern for the future and the biggest potential for more efficiency in actual water resource use are all wrapped up in the same area – agriculture. Water scarcity is above all a threat to food security.

Agricultural water use accounts for about 80% of all the water we humans use. Although only 17-20% of agriculture is irrigated, that irrigated land accounts for more than 40% of all agricultural production. With both upsides and downsides, we have fed an additional three billion people since the mid-point of the last century through intensifying agricultural production, primarily through Green Revolution techniques and substantially, but not uniquely, through irrigation.

Had this not been done, the burgeoning world would have fed itself by extensive means, ie clearing more forests, more tropical lands, denuding more hillsides.

Efficiency in agriculture is about relative evapotranspiration rates, a somewhat difficult word that reflects that plants grow and prosper as they pull water up from their roots and 'exhale' it to the surrounding atmosphere, where it rejoins the hydrological cycle. The question is how much crop yield is procured per unit of water – that is the 'more crop per drop' imperative.

The 'free ride' we have had while we have depleted groundwater resources is coming to its

inevitable end.

India and China between them probably pump about twice the Nile River's worth of water more than rainfall will replenish from underground sources for irrigated agriculture – often the electricity and the water are both free.

We now need drastically improved water use efficiency in agriculture to feed another two billion people with the same amount of water we have had since the time the dinosaurs roamed.

An IWRM approach urges countries – or regions, or water basins – to move away from fragmented and uni-sectoral water policy decisions when solving problems that involve water resource management. It stresses the need to protect societies against floods or droughts, to protect drinking water sources, to make water related decisions in such a way that the interests of the poor and women are taken into account. It advocates participation and improved communication rather than 'back room' policy-making approaches.

The prospect of this magnitude of change is daunting, but many places in the world are already in water crisis and the mediumterm outlook is not good.

Improved water efficiency is anything but an optional extra and, because we all have such a stake in the outcome, can really only be achieved via an integrated approach that treats water as the fragile, holistic resource that it is.

Water is life: where there is no water, there is no life.