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RBC Letter

The Blue Planet

Water is unique, and no other substance is more important to our survival. Yet we continue to ignore the fact that clean, fresh water is in increasingly short supply over much of the world. Are we sunk? Not if we learn to treat water as a human right as well as a scarce resource...

In 1961 the United States began work on sending a man to the Moon before the end of the decade. Environmental considerations played no part in this decision. National prestige – threatened by the launch of a Soviet satellite four years before – was the paramount motive, followed at a considerable distance by the advancement of scientific knowledge. Public concern about the natural environment was then in its infancy, and a trip to outer space seemed to have no environmental consequences anyway. Yet the space voyages that began in 1969 have stimulated the environmental movement in a completely unexpected way. They produced the first photographs of the Earth. Even in a society saturated with images, the blue and white sphere, luminous against the blackness of space or rising majestically over the horizon of the Moon, has stood apart. It has done more to change the way humans think about the place they inhabit than millions of words could ever do. We saw that our world has limits, that it is the only world we have, and that ultimately, we have no choice but to keep it well and whole. Blue sea and white cloud have told us, too, something that is easy to forget in our daily, land-bound lives; we are all living on islands large or small, on a planet where dry land is the exception not the rule. It has become something of a cliché that our world should be called not Earth but Water. And it follows that the human relationship with water will be crucial, as we learn to treat our planet with respect.

Water is unique. No other substance matches its qualities, and for humans and all other forms of life it has no substitutes. We would all die without it – on average, within three days. Considered as an experience it is commonplace. We all drink it, cook with it, and wash with it every day. We only think about it if it is too hot, too dirty or, worse, not there at all. At the same time water has dimensions that go well beyond its practical uses. As a powerful metaphor for life and salvation, water appears in the sacred texts of many religions. Springs and rivers have often been considered holy. Even today people make a wish as they throw coins into fountains, invoking the power of the water, perhaps unaware that they are following a tradition thousands of years old. Environmentalists like to argue that water should be treated as a trust and a value, not as an economic good like cars or potatoes – which is the equivalent, in a secular age, of saying that water is holy. In at least one way they are right. Water came to us, if not from the gods at least from outer space, when icy comets struck the newly formed planet some billions of years ago. There will be no more until we collide with another icy comet, which will be a heavy price to pay for it. Water also has a permanence not granted to mere rocks. We can only make it in quantities that are insignificant relative to the amount we already have. Outside a laboratory we cannot destroy it. For practical purposes all we can do is to use it, move it around, pollute it or clean it up. We do all those things on an ever-growing scale – and when we have finished there is as much water in the world as when we started,

though we may have made some of it unusable or inaccessible.

"Humans depend totally on the less than 3% (of water) that is fresh…"

Water is permanent, and we have a great deal of it – some 1.4 billion cubic kilometres. That should be enough for all human purposes, with plenty to spare for other forms of life. Unfortunately over 97% of the total is in the salt sea that covers almost three-quarters of the planet. Sea water – it contains about 3.5 % salt by weight – is far from useless to humans: it provides a major (though dwindling) food source in its fish, molluscs, plants, and not least, the salt itself. It carries more freight than any other medium, and it is the indispensable ingredient in much of modern tourism, in ocean side resorts and cruise ships. It cannot, however, be drunk without serious, ultimately fatal results. It cannot be used for irrigation. Humans depend totally on the less than 3% that is fresh, and in practical terms much of that is not available for our use. Two-thirds is locked up (at least until the present) in the icecaps of Antarctica and Greenland and the world's glaciers. Much of the rest is well out of reach. Moving water over long distances, in spite of its useful habit of flowing downhill, is almost always expensive and often impossible. About one fifth of the liquid fresh water on the surface of the planet is in the Amazon Basin of South America. It will not be coming out of North American taps any time soon. We are left with perhaps no more than 0.3% relative to the total quantity of water on the Earth.

Even this modest percentage was more than enough for most of human history. Water shortages could certainly be caused by climate patterns or in some cases, human mismanagement. In either case they were local and transitory, although they could result in horrendous loss of life. As on many other fronts, it is the changes of the last two hundred years, particularly the last fifty years, that have put pressure on the water supply. Developed societies use large quantities, for power generation, manufacturing and lavish personal use that in the developed world can reach 600 litres a day per person – ten or twenty times the average for developing countries. Feeding a rapidly increasing world population has meant widespread use of irrigation, by far the largest consumer of water and all too often, one of the most wasteful. Urbanization and rising living standards mean that steadily more people have piped water, baths and flush toilets – all excellent in themselves, but all using water. Air conditioning has played a part, not only by using water itself but by making arid regions, once seen as intolerably hot, desirable homes – desirable, that is, if equipped with plenty of lawns, swimming pools and golf courses, all thanks to water brought hundreds of miles or expensively desalinated from sea water.

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The pressures of social and economic development are being increased by climate change. Some regions receive growing amounts of water in the destructive form of floods or hurricane rains, while others face the prospect of seemingly permanent drought. Precipitation at high latitudes is expected to increase, while Mediterranean Europe, Southern Africa and the West Coast of the United States are expected to become drier, as is Australia, already the most arid continent. Human decisions, on the other hand, not only increase water consumption but often illustrate the law of unintended consequences. The building of dams in particular offers a striking instance of misguided good intentions in the management of water. In 1930 Americans built Hoover Dam on the Colorado, making Las Vegas possible among other results. Stalin, not to be outdone by capitalism, dammed the Volga at Rybinsk, drowning 636 villages and severely damaging the sturgeon fishery in the process. For more than five decades dams were an unchallengeable symbol of modernity and progress. Politicians loved them as, in every sense, solid achievements, impressive backdrops for a photograph. Developing nations loved them as demonstrations of their rapid strides toward a better future. Contractors loved them for obvious reasons, and for aid agencies they combined hydro power, irrigation, flood control, tourist potential and sometimes even improved navigation in one unbeatable package.

It was hard to argue with all this and few tried. Dams rose on all six inhabited continents – over 40,000 of them by one count, including 102 monsters over 150 metres high. Many countries, including Canada, are heavily dependent on dams for hydro-electric power while many millions of farmers around the world depend on them for a steady supply of irrigation water. Nonetheless, disillusion with dams has grown and today it is widespread. Large dams, especially dams in arid areas, can do serious, sometimes irreversible damage to the environment. They endanger upstream river life by changing the water's temperature and

salinity, and wipe out downstream fisheries by blocking the life-giving flow of silt and floodwater. They produce downstream erosion and upstream landslides. If the reservoirs are clogged with decaying vegetation, as they sometimes are, they produce greenhouse gases. Reservoirs can also be breeding grounds for malaria and other waterborne diseases. Dams can sometimes drown irreplaceable archaeological sites and wipe out whole human communities, as the Nubians of Egypt among many others can testify. If water is suddenly released to keep a dam stable, downstream communities are flooded, usually without warning.

Nor was the plus side always as rosy as the planners anticipated. Dams do not always make good use of the water they impound. Reservoirs lose huge amounts to evaporation, especially, of course, in arid climates. The power generated and acres irrigated often fall well short of targets, while cost estimates were regularly overrun. All dams slowly silt up, reducing their generating capacity and in a few cases even threatening their stability. Finally, dams do not always give the people whose lives they change what they want and need – not surprisingly, since until recent years the people directly affected were seldom asked what they thought about it all. Dams are still being built, notably in China, but aid agencies no longer fund them and some in the United States are even being demolished. Perhaps the most significant lesson to be drawn from the story of dams is the danger of relying solely upon top-down, technocratic planning. Water management is a prime example of the need to think locally, weighing each region's unique mix of developmental, political and environmental factors before taking irreversible action.

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Dams often go together with perennial irrigation. Irrigation was the basis of the first human civilizations and it plays a vital role in feeding humanity today. Its appeal is immediate and elemental. Who does not want to see the desert bloom? Sterile wastes become fertile fields, providing food and income for people who have often barely scratched a living. Irrigation is by far the largest human use of water, outweighing all the others combined. Yet irrigation, more often than not, is a highly inefficient use of water. Open, unlined irrigation canals and channels in arid areas such as Central Asia or the Southwest of the United States can lose half the water they carry to evaporation and seepage before it reaches a single plant. Much of what reaches the fields is unnecessary for plant growth. It is lost to more evaporation and seepage or only serves to erode the soil. Worse, in rainless areas, repeated irrigation without provision for drainage or flushing will eventually make the soil so saline it becomes sterile. Too much salt in the soil is an immense and growing problem in river basins as far apart as the Indus, the Colorado and Australia's Murray. It is hard to understand why this was not foreseen, since the dangers of salt accumulation have been known since ancient Iraq.

Dams and irrigation canals were at least built with good intentions. It is hard to say as much for another source of pressure on the water supply, the current boom in bottled water. Europeans have always drunk large amounts and still do, while North Americans have come to believe that water from a "natural" source is healthier, safer and socially more acceptable than the boring old stuff that comes out of their kitchen taps. Food companies have both encouraged this idea and profited from it. Bottled water often has the word "Spring" in its name, since a premium can be charged for spring water as opposed to the otherwise identical water in a river or lake. (It is striking that consumers believe at one and the same time that bottled water is "pure" and that their favourite brand has an identifiable taste. Both cannot be true: any taste in water comes from substances dissolved in it.) The craze has reached such proportions that it has seriously depleted groundwater in parts of the United States. It has also, of course, littered the world with discarded plastic bottles. In a world where at least two billion people have to make do with inadequate water supplies, this is an unattractive phenomenon. The good news is that a number of local governments, including the municipalities of San Francisco and Salt Lake City, have banned the purchase of bottled water for city employees. Likewise, some of the world's leading restaurants are offering their own filtered water to patrons in place of bottled water. And a number of corporations have brought in policies prohibiting the use of bottled water at meetings where tap water is also available.

"…clean, fresh water is in increasingly short supply over much of the world."

Last, but far from least, we have gone a long way towards making the water we do have unusable. Pollution of water by chemicals, bacteria and

agricultural runoff was the first dimension of water management to rouse public concern. After decades of clean-up programmes, some of them successful, pollution has not gone away. The U.S. and Canada, whose citizens like to think of themselves as both clean and progressive, still discharge large amounts of raw sewage into rivers, lakes and the ocean every day, along with large amounts of pesticides, fertilizers, and industrial wastes. As a result, there are 100 First Nations communities in Canada that still operate under a boiled water alert. In much of the developing world and the former Soviet bloc the situation is far worse. Rivers become open sewers. Wells in India (if they do not dry up completely from overuse of ground water) fill with both toxic man-made chemicals and naturally occurring substances such as fluoride (poisonous above a certain amount) and even arsenic. Fear of pollution has been a driver of the move to bottled water: it remains to be seen what will be needed to translate this fear into truly effective action.

All these factors together mean that clean, fresh water is in increasingly short supply over much of the world. The future looks grim. Pumping groundwater – much increased by the arrival of electric and diesel pumps - has seriously depleted aquifers in both developed and developing countries. Groundwater put into bottles has made lakes disappear in Florida and Wisconsin. Decades of using groundwater to irrigate the High Plains of the United States will soon exhaust the huge Ogallala aquifer, leaving one of the world's most productive agricultural regions with an uncertain future. To pump groundwater is to live on capital, since aquifers can take thousands of years to refill, if they refill at all: many of them are "fossil water", legacies from climates that no longer exist. As noted wells are drying up in India, threatening the country's ability to feed itself. Many once-great rivers, drained for irrigation and urban use, no longer reach the sea. Australia's Murray does not, and the Colorado does so only because Mexico, at its mouth, is guaranteed a share of its flow by treaty. Israel and Jordan use the river that divides them so thoroughly that the Dead Sea, into which the Jordan once flowed, is well on its way to disappearing. Even China's huge Yellow River or Huang-He, historically better known for catastrophic floods, fails to reach tidewater in most years. Most spectacularly, the use of Central Asia's Amu Darya to irrigate cotton fields has reduced the Aral Sea to a lifeless fragment of its former size. Even long-established and highly developed communities like the Spanish region of Catalonia face chronic water shortages. Less seriously, but still significantly, in Texas the river of San Antonio's famous River Walk is kept flowing only by diverting treated sewage effluent, while the municipal government of Las Vegas is encouraging homeowners to grow lawns of cacti instead of grass.

Examples could be multiplied, but the lesson is clear: we are demanding more of our fresh water supply than it can give us, and there are no painless or universal answers available. There are no more unexploited resources to rescue us from the consequences of our actions. Nor are there any world-changing technological breakthroughs in sight. Desalination of sea water is expensive in financial, energy and environmental costs and makes sense only in areas that are both very dry and very rich, the Persian Gulf states being both the obvious example and the largest users. The city of Perth, Australia, faced with a major water crisis, has built a desalination plant that is partly powered by wind turbines, but relatively few places have the right conditions for that solution. The inescapable facts remain: we cannot do without water and we cannot make it in significant amounts. All we can do is to use what we have wisely.

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Water management is a global issue in the sense that it directly or indirectly affects virtually everyone living on the planet. Unlike climate change, however, water management is not global either in its chains of cause and effect or in the strategies for dealing with any individual region. The only over-arching challenge is to use the water we have so efficiently that we can not only meet existing demands (or at least the less frivolous of them) while preserving the environment and making adequate water available to the roughly one-third of the human race who do not have enough of it today.

To call this a challenge is a gross understatement. Achieving it will mean whole-hearted and lasting co-operation among the sovereign states that share a river basin, a lake or an aquifer. It will entail major changes in the domestic politics of many, perhaps most countries. Water management cuts to the bone. It affects the way everyone lives and earns a living. Farmers – perhaps the most powerful of all lobbies in democratic countries - who have historically paid little or nothing for vast quantities of water will have to accept economic charges, physical limits or both. Industries that have had privileged access to water

because they create jobs and wealth will have to use it as efficiently as any other input. Urban users who have paid very little will have to learn to think of water as having a price like anything else. Deeply rooted customs and expectations will have to change. Not every home can have a lawn and a swimming pool – or even an herbaceous border and a rose garden. And everywhere the use and control of water is enmeshed in a web of legal rights and traditional customs that have both economic and cultural value to their communities. There is no clean slate to write on: rather, successful water management must begin by taking each society as history has made it.

It is easy to write these things. Unfortunately it is often true that human beings will choose the sensible alternative, but only when all the others have failed. It is also true that different approaches to water management appeal to different people, for reasons rooted in their whole concept of how human society should function. For many the idea of charging an economic price for an essential good like water is repugnant, especially if the charging is being done (as it often has been in recent decades) by private water companies. This school makes the perfectly valid point that world-wide the people who need water most are usually those least able to pay for it. Others will reply that people will not take water conservation seriously until wasting it hurts them in their most sensitive spot, their wallets. They can also argue that the only alternatives are exhortations to voluntary change — which usually is least effective with the worst offenders — or regulation with its accompanying battery of inspectors, fines, and all too often, opportunities for favouritism if not corruption.

In reality achieving the sustainable use of water will require all three policies and more. Educating the public in the crisis is essential, not only to bring about voluntary change but to create the political climate in which comprehensive and permanent change is possible. Realistic pricing is not the whole answer, but it has a valuable and perfectly legitimate role to play. Water may be a human right, but that does not mean it should be a commons, freely available to all. Human rights, to coin a phrase, fill no bathtubs. Bringing water to the point of use requires heavy capital investment in distribution systems and regular spending on filtration, maintenance and waste disposal. Useable water is not free, and there is no reason why individuals and businesses who can afford to pay for it should not do so. Guaranteeing a supply to those who cannot afford to pay is essential both politically and morally, but society has an arsenal of public policy tools to achieve this, without encouraging waste by making water free to all.

"…we must learn to treat water both as a human right and as a scarce resource…"

As for regulation, with all its drawbacks it is essential to prevent "free loading" – benefiting from the system without contributing to it – and to achieve policy goals beyond the reach of education or pricing, such as control over local and international trade in water. Finally, technology, while unlikely to produce miracles, has a role to play in making water conservation measures financially viable and politically acceptable. Efficient showerheads and washing machines, the Israeli invention of drip irrigation, the lining of irrigation channels are all examples of how technology can contribute to change that is incremental but cumulatively significant. In a word, we must learn to treat water both as a human right and as a scarce resource, rather than re-enacting the "tragedy of the commons" by making it the property of all and the responsibility of none.

To repeat, effective water management is not one challenge but hundreds of them, large and small, each with a unique blend of human, physical and financial factors. This means that a key technique for achieving the delicate balance between a human right and an economic good will usually prove to be good governance, the structuring of an effective and legitimate decision-making process. Technical knowledge and central government authority are necessary if we are to make the best use of water, but they are not sufficient. The populations affected must be involved, especially in developing countries where their local knowledge and sense of their own needs can make the difference between failure and success. Transparency is essential if all the factors involved – environmental, economic, social – are to be given due weight. In some countries the political culture and a vigorous media go a long way toward achieving these things. In many, perhaps most, transparency and participation will require changes in the behaviour of both local and international elites.

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Canada is richly blessed in many ways, and in none more so than in our supply of fresh water. The United Nations estimates that Canada has "Total Annual Renewable Water Resources" of 2,902 cubic

kilometres a year – behind only Brazil and Russia in the world, and the largest per capita amount of any sizeable country. And this is the amount renewed each year, not the total volume of water in Canadian territory: it is our income, rather than our capital. These figures, however, if taken at face value can be seriously misleading. Canada's population is concentrated in a small proportion of its territory. Much of the water in the thinly inhabited zone is effectively unavailable for human use, for both cost and environmental reasons. Even within the populated zone water is unequally distributed. Much of the Prairies has historically been subject to drought: in the latest, in 2001-2002, the South Saskatchewan River ran dry. The Great Lakes region might seem to be well supplied, but it is important to remember the difference between capital and income, between water stored in the Lakes and the amount renewed each year. Since the Great Lakes have a relatively small drainage basin, they are vulnerable to withdrawals in excess of the annual intake. The booming interior of British Columbia, valued for its relatively warm and dry climate, is a smaller-scale version of the U.S. Southwest, faced with competing demands for irrigation, tourism, industry and urban use. Vancouver, believed by those who do not live there to be permanently awash, has repeatedly experienced water rationing. Climate change is expected to make these shortages more acute in southern Canada, while increasing rain and snow in the Arctic.

"…we are demanding more of our fresh water supply than it can give us…"

These pressures are one cause of the intense opposition in Canada to all plans for the export of Canadian water. Some fear large-scale projects to replenish the Ogallala or even to rescue water-starved Arizona and Nevada (where, ironically, large numbers of Canadians spend their winters). More realistic are fears of diverting more Great Lakes water into the Mississippi – more realistic, because large amounts have been diverted every day ever since the reversal of the Chicago River more than a hundred years ago. Others fear that the Great Lakes will suffer the death of a thousand cuts, as American municipal and county governments nibble away at them, notwithstanding the opposition of all eight Great Lakes state governments to further exports from the Great Lakes Basin. Schemes to export Canadian lake or glacier water by tanker to arid or drought-ridden areas have surfaced from time to time and doubtless will surface again. Nor are they technically impossible. The Greek islands have become tourist meccas by importing water from Britain. Large polyurethane bags full of fresh water are towed to Greece by a company appropriately called Aquarius.

Public debate has centred on these plans to export Canadian water directly. Attention has only recently begun to focus on a more complex issue, the so-called "virtual" export of water. This is the export, not of water as such but as a means of producing other goods. In effect, we are exporting the use of our abundant water to grow, manufacture or extract goods that would be difficult or expensive to produce in countries with less abundant supplies of fresh water than Canada. Agriculture is the most obvious example, and probably the least contentious although in its case the water actually contained in foodstuffs, as distinct from the water used to grow crops or feed livestock, leaves Canada for good. The vast quantities of water used in the extraction of natural resources, however, present issues of growing importance and great political sensitivity. The water polluted in extracting resources is a classic example of what economists call a "negative externality" – a cost incurred in production that is borne by third parties, not the producer or consumer of the product. Unless producers are required by law to meet the costs of the pollution they create, those costs will be borne by the public either in the form of degraded land and water, or in the costs of clean-up, or both. Since most natural resources produced in Canada are exported, Canadians may find themselves not only exporting the use of their water, but also subsidizing the export industry by bearing the external costs it creates. This possibility has already led to environmental laws and regulations requiring companies to clean up the environments they pollute. The details vary greatly and the results are contentious, but it is perhaps fair to describe them as mixed. Going further down this road will require Canadians to make difficult decisions, weighing the competitiveness of our exports and the well-being of industries that generate great wealth and many jobs, against the growing public belief that, to put things at their simplest, people should clean up the mess they make.

Whatever balance is struck on this issue, it is arguable that Canadians should spend more time planning to use their much-valued water wisely. Public debate in Canada, when it leaves the export issue, is almost wholly concerned, first with the safety of the water supply and next with the effects of polluted water on the environment. These are obviously important issues, but they have hitherto left little room for

ordinary, every-day conservation. The federal and provincial governments recognize the importance of conservation, and to some degree encourage it, but the issue has little resonance with the public. More widespread use of water meters, more realistic water charges, better maintenance of distribution systems, recycling of water – none of these makes headlines and some would be unpopular, but they would help to ensure that future Canadians would be as blessed with water as earlier generations have been.

In the Negev desert of Israel a traveller to the Eilat Red Sea resort will pass a ruined city on a flat-topped hill. Built by the Arab Nabatean people (who also built the famous city of Petra) in the 3rd century BC, it is called Avdat. It flourished from long-distance trade and agriculture for 900 years until destroyed by an earthquake. Today it is a beautiful, peaceful spot, but anyone visiting the well-preserved ruins must wonder how a city could ever have survived in such a place. The view is extensive, but it does not include a drop of water and very little vegetation. Yet Avdat not only existed, it thrived. Water was available to irrigate fields and vineyards – six winepresses have been found - to supply public bathhouses and to justify an elaborate drainage system.

The answer is simple in principle, though incomplete in detail. The Nabateans dug some wells, but more importantly, they saved every possible drop of the scanty winter rainfall. Streets and rooftops drained into cement-lined cisterns which supplied both fields and houses. Pipes and cisterns were covered to limit evaporation. We do not know how else the people of Avdat made sure that none of the precious water was wasted, but whatever they did was clearly effective. In a region most people would think fit only for the herds of the Bedouin, with a rainfall of less than 10 inches in a good year, the careful use of water supported a sophisticated urban civilization. The ruins of Avdat are striking proof of what a community can achieve by adapting to its environment, and should be an inspiration as humanity comes to terms with our bountiful but finite planet.

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