

The myth of overabundance

Canadians were raised with the idea of clean, fresh water until the end of time — but it's not so, says Journal staff writer Hanneke Brooymans in a new book titled *Water in Canada, a Resource in Crisis*. The following excerpt looks at how we waste water and what we can do to conserve it

BY HANNEKE BROOYMANS, EDMONTON JOURNAL MARCH 13, 2011 8:15 AM



Canadians were raised with the idea of clean, fresh water until the end of time — but it's not so, says Journal staff writer Hanneke Brooymans in a new book titled *Water in Canada, a Resource in Crisis*.

Photograph by: Tim Fraser, file, Windsor Star

EDMONTON - Perhaps future generations will take issue with the fact that some of us washed our driveways with water; that we let the tap run when we brushed our teeth; that we pumped fresh water down congested oil wells to push out a bit more black gold; perhaps that we used water to grow potatoes in the near-desert of southern Alberta.

There are plenty of people who already consider these behaviours sinful. But that doesn't include the majority; otherwise, surely, there would be laws against such waste. In fact, a 2010 survey shows that

plenty of us engage in wasteful water ways of life. The survey said that 19 per cent of respondents hose down their driveways . . . Almost half of those surveyed leave the water running while brushing their teeth (46 per cent) or rinsing the dishes (44 per cent). Some of these people are also part of the group of 78 per cent who believe they try hard to conserve fresh water in the course of their daily activities, and the 83 per cent who say they are concerned about the declining state of the availability of Canada's fresh water.

Many of those surveyed in this Ipsos-Reid poll also admitted to engaging in water-contaminating activities, including allowing soapy water to run down a storm drain (i.e. when washing a car) (21 per cent) and using soap or shampoo to bathe in a lake (16 per cent).

And yet one-half (49 per cent) believe fresh water is Canada's most important natural resource -more than forests (20 per cent), agriculture (17 per cent), oil (nine per cent), fisheries (three per cent), metals (one per cent) or coal (0 per cent).

"There is an obvious disconnect between Canadians' attitudes toward water conservation and what they're actually doing," said Bob Sandford, chairman of the Canadian Partnership Initiative of the UN Water for Life Decade, when the numbers were released. "Canadians say they are much more concerned about the availability and quantity of fresh water than any other natural resource, yet their efforts to conserve water are actually decreasing. This should be a huge concern, given that we live in a society run by water and the long-term supply of this precious resource is already at risk in many parts of the country."

Canadians have a reputation for using almost more water per person than any other nationality. The most recent publicly available data show that in 2006, water use in Canada amounted to 60,527 million cubic metres. That's 60.5 trillion litres, enough to fill 24 million Olympic swimming pools. About one-third of this water is consumed, while the rest is returned to the water bodies from which it was taken, Environment Canada says.

So what do we lavish all this water upon?

It seems we don't have a firm grip on this - another symptom of thinking we have more than enough. But Environment Canada cobbled together data it collected from municipalities in 2006 with Statistics Canada information on industrial (2005) and agricultural (2001) use to come up with the following rough estimates.

A full 63 per cent was used to generate thermal power, such as that created when coal or natural gas is burned. The manufacturing sector required 15 per cent. Municipal use rang in at 9.5 per cent. Agriculture also used 9.5 per cent, and mining used one per cent.

A closer look at power production reveals that 140 litres of water are required to produce one kilowatt hour (kWh) of electricity in a fossil fuel plant. (One kWh will power a 100-Watt light bulb for 10 hours.)

A nuclear power plant requires even more water: 205 litres per kWh. Some of this water is converted to steam to drive the generator producing the electricity, Environment Canada explains. "Most of the water, however, is used for condenser cooling. Why is so much cooling necessary? Because today's processes can only convert 40 per cent of the fuel's energy into usable electricity. The rest is wasted. This shows the double costs of inefficient energy use: first, in the waste energy, and then in the water required to cool the wasted heat to the temperature where it can be released safely into the environment. This requires a continuous flow of cooling water circulating through the condenser."

Everything has a water footprint - a concept that gained ground in recent years following in the steps of the better known "ecological footprint" introduced in the 1990s by Canadian William Rees. The water footprint concept, created by Dutch water management professor Arjen Hoekstra, can be calculated for an individual, community, business and country. For a nation, it's defined as the volume of water needed for the production of the goods and services consumed by the inhabitants of the country.

In 2007, Hoekstra and Ashok Chapagain published research on the water footprints of nations. They also quantified how much water was needed to produce crops such as wheat in different countries, and how much water it took to make a cotton T-shirt or a microchip.

The tricky part of calculating a country's water footprint is thinking about everything the people in that country consume, regardless of whether or not it's produced domestically. "A water expert being asked to assess the water demand in a particular country will generally add the water withdrawals for the different sectors of the economy," Hoekstra and Chapagain wrote. "Although useful information, this does not tell much about the water actually needed by the people in the country in relation to their consumption pattern. The fact is that many goods consumed by the inhabitants of a country are produced in other countries, which means that it can happen that the real water demand of a population is much higher than the national water withdrawals do suggest.

"The reverse can be the case as well: national water withdrawals are substantial, but a large amount of the products are being exported for consumption elsewhere."

The idea of the water footprint is tied to the concept of virtual water, meaning the amount of water polluted or consumed while producing food or other products.

Water-scarce countries can buy water-intensive products from other countries, leaving themselves more water.

Canada does not have a flattering water footprint -there's no light ballet-slipper tiptoeing going on here. It's more likely a steel-toed boot tromp and kick. While the average of the 21 countries chosen in the study is 1,240 cubic metres per capita per year, Canada's is 2,049, enough to take about 12,400 baths. Only Italy, Thailand and the U.S. had higher rates.

The authors say there are four important direct factors explaining high water footprints:

1. The total volume of consumption, which is generally related to gross national income of a country.

2. Individuals have a water-intensive consumption pattern. For example, high consumption of meat significantly contributes to a high water footprint. This factor partially explains the high water footprint of countries such as the U.S., Canada, France, Spain, Portugal, Italy and Greece. Next to meat consumption, high consumption of industrial goods significantly contributes to the total water footprints of rich countries.

3. Climate. In regions with a high evaporative demand, the water requirement per unit of crop production is relatively large. This factor partially explains the high water footprint in countries such as Senegal, Mali, Sudan, Chad, Nigeria and Syria.

4. Water-inefficient agricultural practice, which means that water productivity in terms of output per drop of water is relatively low. This factor partly explains the high water footprint of countries such as Thailand, Cambodia, Turkmenistan, Sudan, Mali and Nigeria.

Hoekstra and Chapagain say there are many ways to reduce footprints. "A first way is to break the seemingly obvious link between economic growth and increased water use, for instance by adopting production techniques that require less water per unit of product. Water productivity in agriculture can be improved for instance by applying advanced techniques of rainwater harvesting and supplementary irrigation.

"A second way of reducing water footprints is to shift to consumption patterns that require less water, for instance by reducing meat consumption."

The authors doubt cutting meat consumption is a feasible road, as the worldwide trend for meat shows consumption tends to an increase rather than a decrease. They suspect a broader and subtler approach involving pricing, raising awareness, product labelling and other incentives will be needed.

The general public, though often aware of energy requirements, knows little about the water needed to produce goods and services, they say.

In Canada this lack of understanding is reflected somewhat by the 2010 poll that shows that even at home, about three in 10 (29 per cent) say they don't know what they pay for their water each month, three times the proportion (10 per cent) who are in the dark about their electricity bill.

Hoekstra and Chapagain say there is a third method to reduce water footprints: shift production from areas with low water productivity to areas with high water productivity, thus increasing global water use efficiency. They give the example of Jordan successfully externalizing its water footprint by importing wheat and rice products from the U.S., which has higher water productivity than Jordan. When 75 per cent of a country has a desert climate, it is obviously unwise to attempt full-blown wheat and rice growing. But would countries sacrifice production of a cash crop or manufactured good if they had enough water to manage, but another country could produce the same item using less water?

It's difficult to get a firm grasp on exactly how much water Canadians use. Frank Quinn, a former water policy adviser with Environment Canada, says the department had a person leading the collection of

water-use information in the 1990s, but that person retired and it's not being done anymore. "Nobody knows really how much water we're using in Canada. We can get a rough estimate and that's about it. It's really disgraceful." The lack of consistent data means the department can't show what's happening over a period of time, he says.

There are some spotty numbers trickling in, with the latest data from 2005 showing that Canadians, on average, used 320 litres of water per person per day. Over one-third of that (35 per cent) went to showers and baths, about another third (30 per cent) to toilets. Laundry used one-fifth (20 per cent), and one-tenth (10 per cent) was used in the kitchen and for drinking. Cleaning accounted for the last one-twentieth (five per cent).

A more recent, but limited, survey of households supplied by 34 water utilities across Canada, found that the median volume of water used was 243 litres per day in 2007.

Humans definitely need water for survival - it makes up about 60 per cent of our body weight.

But it takes only a few litres of water each day to replace the liquid we lose through breathing, sweating and defecating.

A healthy, sedentary male in a climate like ours needs about 3.7 litres of water each day, according to the American Institute of Medicine of the National Academies. That amount includes intake from all beverages and foods. The average woman needs 2.7 litres per day. So obviously we're able to get far more water than is necessary to meet our survival needs.

Peter Gleick, an internationally recognized water expert, expanded the concept of basic water requirements in a 1996 paper in which he said people also need water for hygiene, sanitation services and modest household needs like food preparation. He calculated this would add up to 50 litres per person per day. Doing the math, this means Canadians were using 270 litres over and above basic needs each day in 2005.

The rest of the developed world sometimes looks askance at our profligate water habits. Canada has been criticized repeatedly by the Organization for Economic Co-operation and Development (OECD) for our excessive use of water, notes David Boyd in a 2001 report that compares our performance to other countries in the organization. "Since 1980, overall water use in Canada has increased by 25.7 per cent.

This is five times higher than the overall OECD increase of 4.5 per cent. In contrast, nine OECD nations were able to decrease their overall water use since 1980."

Water use continues to rise despite an increase in cost to consumers. Since 1991, the national average price for residential municipal water and waste-water service for a monthly consumption of 25 cubic metres -what an average family uses -has increased from \$25.88 in 1991 to \$40.47 in 2004. That's a 56 per cent increase.

But Environment Canada insists that although prices have increased steadily, in general water prices in Canada continue to remain low compared with the actual cost of providing these services. "Canadian water prices have traditionally been among the lowest in the Organization for Economic Co-operation and Development," the department says.

Compared with the other member countries, Canada had the second lowest price for household water, with only Hungary charging less per cubic metre. Households in the Netherlands, France and the United Kingdom paid up to four times what Canadians were charged. Industrial water prices, however, were fairly similar across the 12 countries.

As anyone could logically deduce, there's a solid relationship between conserving water and charging more for it. Amounts of water consumption are also related to charging for water on a flat rate or metered basis.

This relationship is borne out in an Environment Canada report on 2004 data that shows that flat rates resulted in daily water use of 467 litres per person, while people under metered or volume-based rates used 266 litres each day. The difference has been consistent: consumption is always 70 to 80 per cent higher under flat rates, Environment Canada says.

Canada retains an astonishing number of unmetered households, though the percentage of residential clients that are metered did rise from 52 per cent in 1991 to 63 per cent in 2004. There's a clear difference between smaller municipalities and larger ones. In 2004, 64 per cent of residents in municipalities with 2,000 to 5,000 residents were on flat rates, while only 24 per cent of residents in cities with populations over 500,000 were billed this way.

There is some conflicting information coming out of the Great Lakes basin, though.

"Public water systems currently account for the bulk of consumptive use, comprising one-third of the total, and withdrawals in this category have been increasing in recent years despite the

decline in total withdrawals," says the State of the Great Lakes 2009 report. "Higher water prices have been widely advocated in order to reduce water demand. Observers have noted that European per capita water use is only half the North American level, while prices in Europe are twice as high. However, economists have found that both residential and industrial water demand in the United States and Canada are relatively insensitive to price changes. The over-consumption of water in North America may be more a product of lifestyle and lax attitudes."

Higher prices may still be crucial for providing public water systems with capital for repairs, the report adds, as this can prevent water losses by fixing system leaks, for example. "But reducing the underlying demand may require other strategies in addition to price increases, such as public education on resource conservation and promotion of water-saving technologies."

So what can be done to conserve water? There are a couple of easy targets in every home. Toilets and showers swallow a huge share of every home's water budget. Unflappable homeowners, not cowed by

a bit of plumbing, are installing water-saving fixtures. Between 1994 and 2007, the percentage of households with a low-flow shower head rose from 44 per cent to 62 per cent, Statistics Canada says.

The use of reduced-volume toilets increased substantially as well, more than doubling from 15 per cent in 1994 to 39 per cent in 2007. In its previous report, the agency had a theory about the rapid adoption: "Water and energy prices rose quicker than average between 1994 and 2006. Increasing relative costs may have provided a financial signal for households to retrofit to water-saving fixtures."

Of course, that financial signal is missed by many people who rent. "Renters do not always have control over the type of water fixtures used in their dwelling, nor are they usually responsible for water bills, so there is less motivation for these households to spend the money or time to retrofit," Statistics Canada noted. Those differences show up when the numbers are broken down: low-flow shower heads were installed by 63 per cent of owned homes and 45 per cent of rented homes, while reduced-volume toilets were in 43 per cent of owned homes and 23 per cent of rented homes.

People with more money were also more likely to install water-saving fixtures. In 2006, households with annual incomes below \$25,000 were less likely to use both low-flow showers (52 per cent) and reduced-volume toilets (33 per cent) than households that had annual incomes in excess of \$75,000. Targeted grants or subsidies could help these lower-income households make the switch, a task they would be more likely to tackle if they were also educated about the potential cost-saving benefit.

No province in Canada prohibits the sale and installation of 13- and 20-litre toilet models, according to a 2007 report by the Canadian Mortgage and Housing Corp. (CMHC). "As such, Canada is behind most of the developed countries of the world, including the U.S., when it comes to reducing toilet water consumption."

The use of six-litre toilets is mandated across the entire United States and is considered standard in most parts of Europe, the corporation says.

Canadian authorities are getting pressure to legislate against these water pigs, though. The Canadian Water and Wastewater Association has been campaigning for this legislation for years.

The association even spearheaded, and now posts, a performance report on six-litre toilets, which are put through their paces with a cylinder of soybean paste "having similar properties to human waste."

The CMHC says the hesitancy to prohibit the 13- and 20-litre toilets appears to stem from two concerns: the perception that water-efficient toilets do not perform well, and the perception that efficient toilets do not provide enough water to adequately transport waste to the sewer.

The first concern was addressed through the aforementioned toilet testing program, which the CMHC also supports. To date, the program has identified more than 200 models that are almost certain to exceed customer expectations for performance. The second concern regarding the ability of water-efficient toilets to transport waste to the sewer was dealt with by a CMHC study, which proved there was no issue.

In all of this adoption, Ontario appeared to be leading the way due, at least in part, to regulatory changes to the Ontario Building Code in 1996, which made the use of water-saving fixtures mandatory for all new structures. In the spring of 2010, Ontario announced a proposal to require that all toilets sold in the province use no more than six litres of water per flush. B.C. also requires low-flow toilets in all new construction and renovation, but seems to be the only other province to have done so thus far. Many municipalities across the country have taken the initiative, though, enacting bylaws requiring low-flow toilets.

Government regulation is a key part of changing water use rates. Governments have a critical role to play in changing water use habits. If Canadians receive good governance from all levels of government, there should be no obstacles to achieving efficient, appropriate water use. This means regulation of all kinds, on prices, devices, allocation and reuse, say Karen Bakker and Kathryn Furlong in a 2008 policy report.

The duo focused their research on the relationship between governance and sustainable water management practices by municipal water-supply utilities. They talked to experts and people working in municipalities to figure out what had to change. "A key issue in advancing water conservation is a lack of accountability for sustainable water use at all levels of government," they wrote. "The problem of insufficient accountability is often identified as a lack of political will."

And that political will can't be a flash in the pan, either. "Analysts at the Policy Research Initiative [a federal policy agency] argue that it is an absence of sustained leadership and political will and not the nature of the governance strategy itself that limits progress on sustainable development in Canada," Bakker and Furlong wrote. "They find Canada's federal sustainable development governance strategy to be as functionally sound as that of European countries whose approaches have produced tangible and impressive results (e.g., Germany, the Netherlands and Denmark)." Once everyone agrees on a vision for water management, it's necessary to bolster that vision with quantitative long-term targets, interim milestones and ongoing monitoring and reporting, the analysts added in their 2002 report.

If governments are tackling the water conservation issue, it appears to be a pretty low-key affair. The 2010 Ipsos-Reid survey showed only one in three people was aware of local government initiatives to conserve water. Awareness was highest in British Columbia (47 per cent), Saskatchewan and Manitoba, (38 per cent), Ontario (35 per cent) and Alberta (32 per cent) and lower in Atlantic Canada (22 per cent) and Quebec (21 per cent).

One of the best approaches for dealing with water challenges is called integrated water resource management, the Policy Research Initiative says in a 2009 report. This flexible, place-based approach brings together the authorities responsible for making water management decisions with all the interests that depend on that water.

"The resulting arrangement will be unique in each case, as participation will depend on the level of water use, the types of water use, the types of challenges the area is facing, and the geographic scale at which these uses and challenges interact."

Currently, there are at least 115 decentralized governance arrangements at the provincial or territorial level in Canada that play important roles in making water management governance structures more integrated and place-based, the report says.

Although it is widely acknowledged that this watershed-based, tailor-made approach is best suited to dealing with water issues, its specialist nature also makes it vulnerable. In each watershed there are key sectors that need to get along, and in each watershed these sectors will be represented by different people -whose personalities may clash. The size of the watershed in question can vary each time, as can the nature of the problem that is bringing together people in the first place. And each time there may be a different mix of authorities-federal, provincial, municipal-needed at the table. Again, this depends on the problem.

The bottom line is that there are no cookiecutter solutions to be handed over to each watershed. But there are things the federal government can do to make things easier, the analysts say. One of the strongest contributions will be providing standardized data and science of the water resources in question. Figuring out what the in-stream flow need is and then managing water use to meet that need will be a key goal for each of the watershed organizations. "It is clear that as pressures on the availability of water resources build, the federal government will be obliged to make difficult and potentially contentious decisions to fulfil its responsibilities and ensure that in-stream flow needs are met in situations of decreasing availability and increasing demand," the analysts wrote.

There are some very simple things individual Canadians can do to reduce water use and protect water supplies from contamination:

- As mentioned earlier, install low-flow toilets and shower heads. Never flush garbage or expired medication down the toilet.
- Always repair leaky faucets.
- Don't run water continuously while brushing your teeth. Same goes for kitchen activities such as washing dishes or vegetables and fruits. Partially fill the sink and use that water instead. A quick rinse afterward will finish the job. And storing a pitcher of water in the fridge means you don't need to run the tap to get a cool drink.
- Always fill the washing machine and dishwasher to capacity. Use detergents that are biodegradable and don't contain phosphates.
- Water indoor plants with water from a rain barrel.
- Water lawns and gardens on cool, windless mornings. Using water from rain barrels is ideal, but if you're using a sprinkler make sure it isn't overshooting onto pavement. Better yet, select a drip or trickle irrigation system to deliver water efficiently to the roots of plants that need it. If a sprinkler is used, select one with a timer that sprays the water close to the ground. Lawns usually need just 2.5 centimetres of water a week to stay healthy, particularly if they're not cut too short. A Frisbee or empty

tuna can placed on your lawn will fill up when you've delivered that much water. When mowing, a minimum blade height of six to eight centimetres is generally recommended.

- Plant trees, shrubs and flowers instead of grass. Choose species that are drought tolerant, and you will need much less water through the summer.

- Use a broom instead of water to clean your driveway. Doing so could save you hundreds of litres of water each time.

- If you're washing your car, try a bucket and sponge and not a running hose. Or, a hose with a trigger nozzle can save you buckets of water. Don't use toxic products while washing your car. That water could end up in the nearest river or lake.

- If you have a lake lot, don't destroy any of the natural vegetation in the bed and shore of the lake. Plants filter any water that may be running down from your lot. Also, don't use pesticides and fertilizers if you have a lawn. The fertilizer will contribute to algal blooms in the lake, and the pesticide could harm sensitive aquatic organisms.

Of course there are countless other watersaving ideas out there, some of which might be unique to where you live. Further inspiration and ideas can be drawn from the few intrepid souls who have aspired in recent years to get by on just 25 litres of water a day—one-thirteenth the water that an average Canadian uses. The Water Conservation Challenge began in 2009 when Winnipegger Kevin Freedman challenged himself to use no more than 25 litres of water per day for an entire month. That amount included water to drink, cook with, shower in, wash clothes, flush the toilet, brush teeth, wash dishes, wash hands and so on. His goal was to stay both healthy and hygienic throughout the month-long experiment, and he succeeded.

In 2010, a few others tried to duplicate his achievement. The project involves a lot of sponge baths and creative capture and reuse of water, especially for flushing toilets. At the beginning of her 31 days, Saskatoon resident Alina Siegfried reported what she called "auto-pilot-turning-on-the-tap incidents," a habit likely common to many Canadians. Soon enough, though, she was able to "bank" unused water. "Actually, in truth this challenge has been a lot easier than I thought -and once you make the big changes such as using grey water to flush and bathing out of a bucket, it is not difficult at all to come in under 25 litres of water per day," she wrote in her blog.

Taken from Water in Canada, A Resource in Crisis, by Hanneke Brooymans. Reprinted with permission of the author and Lone Pine Publishing.

HOW MANY LITRES OF WATER DOES IT TAKE TO PRODUCE:

- 1 glass of beer: 75

- 1 apple: 70

- 1 cotton T-shirt: 2,000

- 1 hamburger: 2,400
- 1 pair of bovine leather shoes: 8,000
- 1 microchip: 32
- 1 tomato: 13
- 1 automobile: 120,000

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