Water in Canada: Myths and Realities

Harry Swain
Centre for Global Studies, University of Victoria

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Good morning, and welcome to the 2009 ACCWA Conference. It's a delight to be here on the Halifax waterfront. Back in 1976 I co-chaired an intergovernmental committee that tried, among other things, to persuade the local authorities that a waterfront collector sewer would be a really neat idea—a first step toward a sewage treatment system. Happily they understood that first steps get followed by expensive second steps and wisely refused my advice. I understand that more persuasive people have come along since, with the result that downtown is no longer as fragrant as it once was. Soon my home town of Victoria will be the last city in Canada with no treatment at all, unless you count a quarter-inch screen as treatment. But B.C. authorities are determined that this will be a temporary distinction, so that despite the evidence that the only measurable biological effect is that the mussels within 100m of the outflow are bigger and fatter than their impoverished neighbours, we are going to install a secondary treatment system that will have no effect at all on the actually dangerous stuff.

But I am getting ahead of myself. What I want to discuss with you this morning is the persistence of popular ignorance—indeed the deliberate fostering of certain myths—about water in Canada. It never ceases to amaze me that so fundamental a resource, which is the focus of a large and highly competent technical community, can also be the focus of so much nonsense. My purpose this morning is to talk about seven of my favourite myths in the water trade and so to get your proceedings started in a reasonably lighthearted way.

The gringos will steal it!

The first is the profitable little industry clustered around the idea that bulk water exports are a clear and present danger to the Dominion. Maude Barlow and the Council of Canadians fill my mailbox several times a year with appeals for money to stop the imminent rape of Canada's water resources by the dastardly Yankees. Water aside, the paranoid approach to our neighbour's interests is unseemly at best, especially since there has been no serious attempt to steal Canadian resources since the War of 1812, which fortunately we won. But it is apparently good for fund-raising, and for promoting Maude to being an advisor to Secretary General Ban Ki-Moon.

The fact is that exporting water can only be done with gravity on your side. Otherwise the energy costs of moving it, by tanker, truck or pipeline, will just kill you. Pumping costs are much greater than the value of raw water. Those of you operating municipal waterworks know right away how important pumping costs are as a proportion of your O&M.

The exception is the Chicago Ship and Sanitary Canal. Under pre-1906 rights, carefully reserved under the new Great Lakes Charter, Chicago drinks from Lake Michigan and excretes into the Mississippi. The negligible height of land between the lake and the river makes this uniquely possible. Chicago has rather theoretical legal rights to divert more, but in practice will in all likelihood abide by the restrictive procedures of the Charter.

Of course the Columbia River takes large quantities south, just as the Red takes quantities north. But these are natural flows, and they are not easily augmented. At the very least, a greater flow in the Columbia would require interbasin transfers and land flooding in Canada that would not pass even the most rudimentary environmental screening. What are the alternatives? Well, for the same reasons the vast and delirious schemes of forty years ago, like NAWAPA or the reversing of the rivers that flow into James Bay, remain what they have always been—vapourware. Coastal tankers? Dubious. And the reason is more than regulatory. It is cost. Remember that the competition is desalinated seawater at less than $\$3/m^3$ using flash distillation, or perhaps a third of that using reverse osmosis. Nuclear-powered desalination by either technique puts an effective price cap on the amount the US would be willing to pay.

Parenthetically, US problems with water supply in the dry west and southwest have much more to do with failures of public policy than with water quantities as such. Rigid FITFIR (first in time, first in right) regimes and the failure to price water at anything like its cost or scarcity value have led to massive mis-allocations in California, Arizona, Colorado, and along the Rio Grande. Even with all the political difficulties involved, it will always be cheaper to fix these institutional problems than to import large quantities of water from Canada. One does not need to assign altruistic motives to the US government in order to predict that its interest in bulk water imports from Canada is no more than an occasional idle thought in uninformed minds.

We've got lots

Second myth, or rather, two opposing myths. The dominant one is that Canada has lots and lots of fresh water—more, per capita, than any other country, and that therefore we can treat it like a free good. We can afford to waste it, we don't have to purify it (because, as my home province believes, in Super Natural BC bears do not poop in the woods, as was said shortly before Vancouver gave the nations its biggest Boil-Water advisory ever), and we can forget it as a matter of public policy and investment. And in Toronto, at the navel of the universe, where Canadian attitudes are manufactured daily, the underlying belief is that southern Ontario, our highest-demand region, is a sponge cake of Paleozoic limestone saturated with water, surrounded by the Great Lakes, a land on which a meter of fresh stuff falls annually. How could there be a shortage?

The counter-myth is that we're short regionally now, and it's only going to get worse. Despite the stock statistics, we have to remember that only the flow—perhaps 2 percent of the stock—is available in the long term, and most of that runs uselessly north to Hudson's Bay and the Arctic. Some regions, like the Okanagan, Palliser's Triangle and the Grand River Valley, are already stressed.

Both dogmas are part of the national debate. Like the Red Queen we seem capable of holding two contradictory beliefs before breakfast every day.

Here's a way to square the circle. First, it really is true that in most parts of the country we have so much in the way of flows of fresh water that, historically, we haven't had to pay much attention. On any world comparison, Canada is truly blessed, even if a lot of the fresh water runs only to the Arctic seas. Second, there are some regions where development has outrun water supply—and where we have yet to find pricing or other allocation mechanisms that make sense. I have some friends whose home, in suburban Kelowna, abuts a vineyard. The vineyard is now using drip irrigation so that the vines get only enough water to make excellent, highly concentrated wine, and our friends have ripped up the lawn and gone xerophytic. Now this is partly because they are lazy and hate mowing, and for the vineyard owner it is partly because their allotment of water from the local irrigation district is capped, but at least all the incentives are pointing in the right direction.

Pricing, or pseudo-pricing, really is the only way to go. If the farmers of Palliser's Triangle paid the costs of their irrigation water, or the oil sands companies had to pay the full costs of the waters they foul or consume, there would be both a more modest rate of development and an increased concentration on better engineering. In every sense we, not Nature, are the authors of our own misfortunes.

Bottled water's better

Turning now to drinking water, what are we to make of the fad for bottled water? To the degree that there is any logic at all in this triumph of fashion and marketing for pampered populations, it rests with one of the failures of our industry—the fact that we have two-tier water service in this country. The big cities and larger towns produce and deliver water of exceptional quality, usually better than anything that comes in a bottle at a thousand times the cost. In fact, as we all know, a lot of bottled water comes straight from municipal systems, perhaps with a dose of UV added so an advertising claim can be made.

No, the problem is that too many of our smaller systems cannot produce water with the same high assurance of potability that the big ones can. There are huge economies of scale in this business that mean both that the cost of a finished liter declines as market size rises (although distribution does not have the same characteristics)—and so does the probability of microbiological exceedances.

This point about microbial safety deserves more research. We spent some time on it during the Ontario study of financing and management. The data are hard to come by, as they are mostly hidden in utility reports to provincial overseers when they are collected at all, and the really dangerous stuff, actual microbiological contamination, is obscured by oceans of minor technical failures, precursor information, and general *paperasserie*. Simply cleaning the data took a lot of time, and I must say fostered a certain paranoia among the investigators that there were serious players who preferred obfuscation to the sunlit uplands of honest reporting.

Maybe there's something in this. The empirical truth is that we get down to reasonable costs and reasonable assurances of purity when systems serve on the order of 10,000 households, or 30,000 people. Of course local circumstances vary, but these are pretty robust numbers. The US EPA uses them in their regulatory design. So why do we tolerate hundreds and thousands of rinky-dink little systems in this country that can't

afford consulting engineers on call, or microbiologists, or even the most elementary field testing of water quality?

Part of the answer lies with the complacency of many Canadians. We believe nature is benign and that natural waters are inherently safe. In consequence we indulge our municipal politicians in local empire-building. For many municipalities, the waterworks are their biggest enterprises, and the ability to appoint one's political friends to the governing body can be rewarding in several ways. When threatened with consolidation, or even the idea of contracting out to an organization with manifest technical and operational skills, they tend to wrap themselves in the flag of local particularism and decry the loss of local control. This is certainly the case in Ontario, which has at least five times as many water providers as it ought to have. In B.C., we believe that if it's worth doing a thing badly, we should set new world records. We have a third of Ontario's population but about fifteen times as many water providers—about 4,000. All across the country, pusillanimous provincial politicians indulge their municipal confrères by running risks with public health, crossing their fingers that the next Walkerton happens on somebody else's watch.

So yes, unfortunately, there are many places in BC and across the country where the prudent traveler, unequipped with the relevant antibodies, might want to boil the water, or subsidize the plastics industry.

Water treatment's no good, but sewage is just fine

During the Walkerton Inquiry, the noted Quebec microbiologist Pierre Payment observed that Lake Ontario was a bathtub whose waters circulated slowly counter-clockwise, and that both intakes and outfalls tended to be about 10 meters down. In other words we go out of our way to source our drinking water from the ring in the bathtub.

The problem with sewage treatment in Canada is not so much the standards, though they are deficient in at least one important way, but because enforcement stinks. In a word, the provincial enforcers do not want to cause difficulties for the poor darling municipalities—partly on political grounds, and partly because the cost would just blow back on them anyway. Note that if wastewater utilities were not so intimately tied to municipal governments and municipal taxation the enforcement problem would be greatly reduced.

Basic sewage treatment, as everyone in this room knows, lowers biological and chemical oxygen demand, total suspended solids and coliform to acceptable levels. Reduction of phosphorus and nitrogen where eutrophication is an issue is also pretty straightforward. However, there is growing concern about trace chemicals: endocrine disruptors like the synthetic estrogens in birth control pills, certain pharmaceuticals, pesticides and antibiotics, persistent organics—chemicals that are not adequately challenged by secondary or tertiary treatment, and for which standards have generally not been set. These chemicals, which fish must breathe, are increasingly suspected of having serious biological effects. Minnows at the Burlington lab, for example, tend to become hermaphroditic after even nano doses of those birth control pills that pass unaltered through both humans and their sewage treatment plants. I have even heard it whispered that the secular decline in human sperm counts is related to the free circulation of these

trace chemicals. Few scientists want to go on the record with this, however, as they value a quiet life.

The federal and provincial governments have been wrestling for some years with an update to sewage treatment standards. It is this movement that has resulted in nonsensical orders to Victoria, for instance. But the new—really, restated old—standards do not deal with the newer chemical problems. One suspects that this has much more to do with provincial departments of finance wanting to minimize costs than it does with any deep concern for aquatic environments or even public health. It never ceases to amaze me that politicians and media who are quick to jump on any perceived conflict of interest among political figures continue to ignore the huge, systematic conflict in the setting of water and wastewater standards. Which leads to the next myth:

Our regulators are on top of this

The cheque is in the mail, and I'll still love you in the morning. If in general we have spotty enforcement of our existing regulations, at least our larger and better utilities have pretty rigorous internal quality control procedures, and we have a distinguished professional association of which ACWWA is part which is continually working through such important ways as courses, publications, and a move toward accreditation to improve performance. Rather it is the standard-setting process itself I'd like to draw your attention to.

Here's how it's supposed to work. Health Canada convenes a federal-provincial-territorial committee of officials to draft standards, based on the Department's review of the global scientific effort. MAC (maximum allowable contaminant) levels are proposed and published for discussion. The eventual scientific consensus is codified in guidelines, which in turn are all but universally adopted as regulations by the (mostly provincial) bodies that are responsible for water quality. The whole expert process is removed from the partisan political arena, and the standards that result reduce risks to the public to as low a level as practicable. Since treatment costs are low, this is a very low level of risk indeed.

Now here's how it actually works. Mid-level bureaucrats from environment or like ministries are assigned to the committee. They may have expertise in one or more aspects of water treatment, but they are more likely to be middle managers whose technical training, if any, is neither recent nor deep. They are given little guidance from home office except for the basic one: don't do anything that is likely to have a measurable fiscal impact on the province or its creatures the municipalities. They are thus guided more by cost than rational equimarginality of risk in setting their standards. The consequence is that we have ridiculously high standards from some rare contaminants coupled with a reluctance to make filtration a mandatory part of the treatment chain. It was this longstanding failure, pushed behind closed doors by provinces whose names cannot be mentioned but prominently feature one with the initials B.C., which accounts for the fact that Vancouver gave us far and away the biggest boil-water advisory in the nation's history not too long ago. Hey, what's a little turbidity among friends?

So, while ignoring the 800-lb. bear in the woods, our officials assiduously pursue other possible contaminants to the very margins of measurability. The process goes something like this. First, substance A is fed to rats in increasing doses. Eventually some

biological effect is noted. A threshold is set at, say, one or two magnitudes lower, just to be safe. Then another magnitude or two is subtracted for interspecies difference, and maybe another for size differences. The idea is to set a limit for human consumption such that, if a person were to drink two liters of water contaminated at this level for seventy years, she would have a 1 in 100,000 greater chance of developing a neoplasm.

Now this is what I call theological standard-setting. It cannot be measured. There is no way you could pick out an extra case of cancer in a population of 100,000 even if you had seventy years to wait. The standard exists as a statement of faith only. We can afford these heavenly, these faith-based standards only because they so rarely come into play, and therefore cost very little. Of course, to ensure they do not come into play, we are careful not to measure Becquerels per liter of U_{235} very often.

I think the only way around foolishness of this kind—and I would include effluent standards as well—is to maximize the sunshine that falls on the process, something that is much more easily achieved with internet techniques than it has ever been before. I would also include experts nominated by the AFN and the Inuit—not shamans professing traditional ecological knowledge, but persons genuinely expert in one of the many disciplines relevant to standard setting, not excluding economists.

Mentioning aboriginal Canadians is not accidental. The federal government has recently discovered that the combination of S. 88 of the *Indian Act*, S. 91.24 of the old *BNA Act*, and recent court judgments have left a complete void with respect to water management on reserves. Nobody knows whether the void extends to the very large territories that have been ceded to native groups north of 60. There is an attempt going on now to gain AFN consent to a new federal act, but the scuttlebutt is to the effect that merely referencing provincial standards will not do the trick. It leaves aside the rather vital questions of who will do the enforcement, whether an Indian representative might join the faceless officials who set the standards, what to do about the North, and indeed what to do about the other federal lands—parks, military bases, and so on—for which standards and enforcement are also lacking.

It's too costly to fix

The sixth myth is that it's too costly to fix. Fortunately, this is nonsense, in part because we don't have to fix all the derelictions of the past at once. The same thing that makes it affordable—the fact that we have ten or twenty years to bring things up to scratch—is the same reason nobody pays much attention. It is rare that we get a Walkerton crisis to spur reform. Even the Great Vancouver BWA got a yawn—the authorities were able to say that a new filtration plant was under construction, no one got visibly or measurably sick, and everybody went back to sleep.

The plain fact of it is that we demonstrated in Ontario that the whole problem, water and sewage, could be fixed for less than a bottle of scotch per household per month…two bottles if we allowed the politicians to keep all the present water suppliers in business. That's the cost: a bottle of decent booze, half a carton of cigarettes (or four cartons if you buy them at Kahnawake), the cost of a high-speed internet connection, or a fraction of your teenager's monthly cell phone bill. Clean water is a heck of a bargain. Of course we can afford it.

The real problem with our coastal waters is DFO

This is tempting, as the Department that put an end to the Atlantic cod and is busy doing its holy work with the Pacific salmon, vies closely with Heritage Canada as the goofiest department in the whole federal government. This is true even though DFO is a big player in the Bedford Institute, one of the few federal glories in the water world. But tempting as it is to malign a department that requires putting a potty on my sailboat while Victoria gaily flushes straight to sea, the truly guilty party in our coastal waters and beyond is carbonaceous humanity in general.

The real problem is CO_2 in the atmosphere, which comes down as carbonic acid—H_2CO_3—almost all of which winds up in the ocean, after a mean atmospheric residence time on the order of a few hundred years. In other words, most of the increase in atmospheric CO_2 since the Industrial Revolution is still swirling around up there. However, enough has descended to take the average acidity of the global ocean from a pH of 8.2 down to 8.1. And at 8 we start losing aragonite-based fauna. Some scientists think we have already passed the point of no return for all species based on aragonite or calcite—based on shells or bones, in other words. If true this is a global disaster of incomparable dimensions.

For several years now there have been warnings of corals in trouble. All over the globe, from the Caribbean and the Great Barrier Reef of Australia to the cold-water corals of Kamchatka, there have been reports of coral death. There have also been a few reports of re-growth from rather expensive human interventions in Japan and elsewhere. At the famous marine biological lab at Friday Harbor, in the San Juan Islands, careful studies of the life trajectories of animals that swim freely before attaching themselves to a rock and growing a shell have shown an exquisite sensitivity to acidity. It prolongs their period of free-floating adolescence, when they are most vulnerable to predation, slows shell growth, and delays sexual maturity. Bad news! In the extreme, within a century as pH drops below 8, we could be looking at a world ocean principally populated by jellyfish and slimes, a species extinction that would rank with the most revolutionary in earth history. And we may already be past an irreversible tipping point.

Circling back to fresh water, the same greenhouse gases will accentuate Prairie aridity, lower the levels of the Great Lakes, and change the hydrologic regime in my home province. There, we expect that climate change will extinguish cross-Cascadian anadromous fishes. This might at least allow us to cash in DFO, as the value of the salmon catch plunges below the costs of enforcement. It will make the depredations of the Mountain Pine Beetle permanent, as there will not be enough summer precipitation to grow another cycle of Ponderosa and lodgepole pine. It's a good thing BC has a Ministry of Forests and Range—no flies on our government! It will bankrupt many ski resorts, as the snowline rises: for a preview, watch the Whistler Olympics, especially if the current weak El Niño continues. And from a public policy point of view, it will put a premium on brilliantly re-negotiating the Columbia River Treaty four years from now. The value of water storage under that treaty is rising considerably, but brilliance in negotiation depends in part on modeling precipitation and stream flows over several decades, a matter that has so far escaped Ottawa's notice.

The bottom line is that even with all the new attention to water matters in recent years, we are still in thrall to old myths. We are not, in public policy terms, driven by empirical evidence. We seem to be ignoring the big issues like ocean acidification, preferring to focus on bogus ones like American predation or the cost of doing things right. We believe, with unexamined inconsistency, that we have all the water in the world as well as looming shortages. We ignore the most powerful tool in the policy kit—pricing—and assume that some change in the machinery of government, such as a national water strategy led by Ottawa on dubious constitutional grounds, or a declaration that water is a human right, will fix things.

I don't think the machinery is the problem. We have lots of organizations, in the federal and provincial governments and in the universities, which are doing excellent work and could take on new work commensurate with the scale of the issues. What we lack is an informed and demanding population, which is the only thing that will force attention and resources from the political classes. I think professional organizations like the CWWA and its constituents should take on a larger and more insistent role in the public arena, based on the kinds of serious analyses of which they are uniquely capable.

Thank you for your attention. Realizing that one or two of the things I've said may be mildly contentious, I would welcome the correction of my views.