Ingenuity Trumps Hard Tech

The water soft path is the best bet for Canada's public and ecological needs.

Oliver M. Brandes and David B. Brooks

THROUGHOUT HISTORY, water management has meant constructing dams, digging and drilling wells, and extending canals and pipelines into cities and farmers' fields. Industrialized nations have been spectacularly successful at delivering vast amounts of water wherever and whenever it was required. In wealthy countries, water has been readily available to humans, their farms, factories and power-generating stations, with sufficient quantities left over for gardens, parks and swimming pools. Imagine Las Vegas.

Reducing demand appears to be our best "source" of water.

Despite how well the system has worked historically, the day has passed when water planners can rely on new supplies to satisfy demand. Although many Canadians believe that freshwater resources are limitless, the reality is that only a small proportion of our water is both truly renewable and located close to where we live. A 1995 World Bank report entitled Toward Sustainable Development of Water Resources indicates that direct costs to develop additional freshwater double every 10 to 15 years. Climate change, increasing pollution and rampant urban and industrial development are further stressing our freshwater resources. Within the past few years, according to Threats to Water Availability in Canada, a report published by Environment Canada in 2004, during the last half of the 1990s, over one-quarter of Canadian municipalities faced threats to the quantity of their water, and many more faced threats to its quality.

"The trouble with water," as Marq de Villiers explains in his award-winning book *Water*, "is that they're not making any more of it. They're not making any less, mind, but no more either." At the same time our population in Canada is on the rise. As a result, the key to water management lies in shifting the focus from expanding supply (supply management) to moderating demand (demand management through technical fixes such as low-flow shower heads and economic incentives such as volume-based pricing) to a long-term and fundamentally holistic approach dubbed the water soft path.

When viewed on a spectrum and as illustrated in "Planning" on page 13, these three water management approaches – supply management, demand management and the water soft path – are incremental steps on the road toward sustainable water use. However, far from being a simple progression, these options differ in ways described in "Benefits" on page 12.

Since reducing demand appears to be our best "source" of water, demand management needs to become the primary policy focus of water management if sustainability is the objective. In California, studies undertaken by Peter Gleick in 2003 indicate that total urban water use could be cut by 30 per cent using cost-effective, off-the-shelf technologies that can be implemented in less time than it takes to develop a new supply. If these technologies were adopted, California could avoid tapping new sources for three decades.

Harnessing the potential of existing technologies and economic incentives that result in the efficient use of water is a first step toward a more sustainable practice, but it doesn't go far enough. Indeed, Sandra Postel surmises in an article published in *Natural Resources Forum* (29:2) that water withdrawals already impair nature's ability to provide ecological services. Water soft

An Innovative Framework

THE REALITIES of urban water management in the 21st century demand a much more comprehensive and strategic approach to water conservation and efficiency. We just can't keep doing the same old thing. The water soft path offers a new perspective on the challenges that are quickly emerging today: new source protection laws, climate chaos, out-of-control urban growth and changing urban landscapes.

The water soft path is an innovative framework and principled planning approach that integrates the many conservation and efficiency tools at our disposal and puts them into a cohesive plan. It moves beyond the technical aspects of water supply-management and efficiency to fundamentally address the complex interactions of strategic planning, community action, and vital aspects of human behaviour that will be needed to develop a lasting water ethic and the long-term thinking that is absolutely critical to a sustainable water future. In this very real sense the water soft path becomes the only option in a world where water is recognized as the foundation of a healthy, wealthy and ecologically secure society.

– Glen Pleasance
Chair, Water Efficiency Network of the Canadian Water and Wastewater Association (CWWA)

Water Soft Path Principles

1. Treat water as a service rather than an end in itself.
2. Make ecological sustainability a fundamental criterion.
3. Match the quality of water delivered to that needed by the end use.
4. Plan from the future back to the present.

Myriah Tonge

Although many Canadians believe that freshwater resources are limitless, the reality is that only a small proportion of our water is both truly renewable and located close to where we live.

paths go beyond efficiency by seeking to change water-use habits and water-management institutions so they lead to long-term ecological and social sustainability.

The soft path approach changes the conception of "water." Instead of being viewed as an end product, water becomes the means to accomplish specific tasks, such as sanitation or agricultural production. Conventional demand management asks: How can we get more from each drop of water? Water management based on a soft path asks: Why should we use water to do this at all? Why, for example, do we use water to carry away our waste? Demand management recommends use of low-flow toilets, whereas a water soft path promotes the use of waterless or composting toilets, and on-site waste treatment and reuse for larger buildings. The difference in total water savings is considerable according to *The Soft Path for Water in a Nutshell* (FOE, 2006): 80 to 90 per cent for a water soft path versus 30 per cent for demand management as compared with business-as-usual.

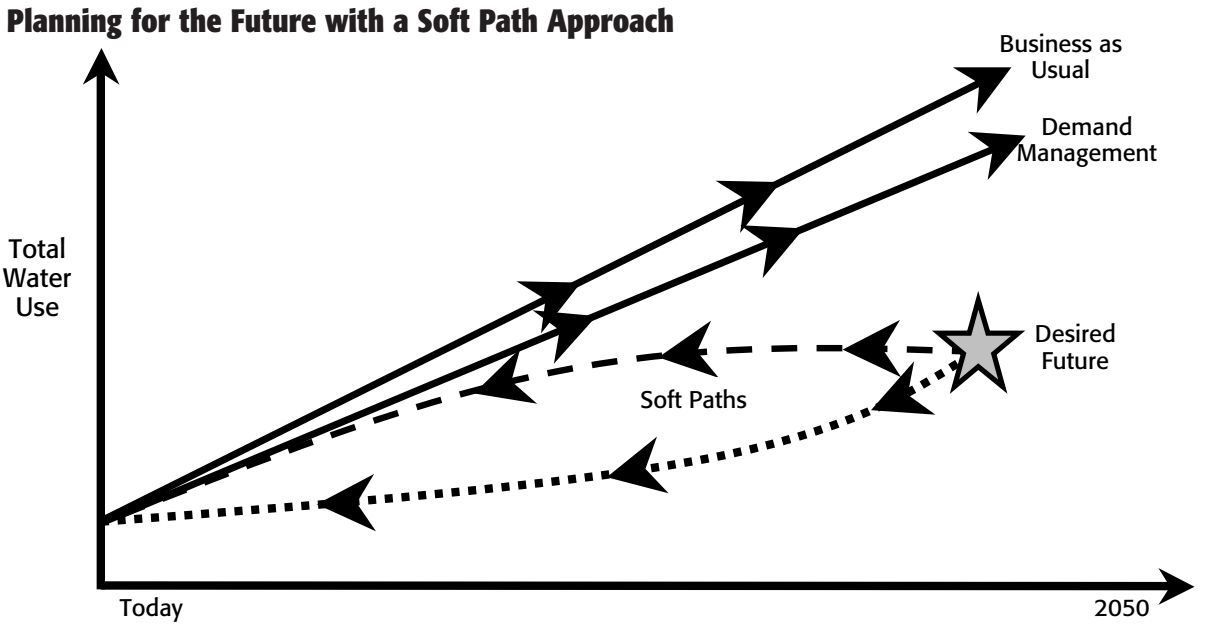
By asking the question why, the soft path increases the potential for saving water. And the approach is not just applicable to houses and gardens; it can also be used in large buildings, factories and farms.

The water soft path has four core principles. It suggests we treat water as a service rather than an end in itself. As such, the services water provides may be replaced by other technologies or techniques. In the case of toilets, composting can replace water. But humans are not the only users of water. As a result, another core principle is that the soft water path incorporates constraints that limit the amount of water humans can withdraw so that shortages don't disrupt how ecosystems function. One means of accomplishing this is to match the quality of water delivered to what is required. Ideally, wastewater from one task is used by another. For instance, grey-water from a washing machine can be used on a garden.

According to Alan Kay, who is credited with conceiving the laptop computer, "The best way to predict the future is to invent it." In terms of a water soft path, the best way to reduce our water use is to invent, or at least

Benefits of the Water Soft Path

Policy	Dominant Discipline	Range of Policy Choices	Fundamental Question	Planning Process	Outcome
Supply Management	Engineering	Policies based on presumed need for new infrastructure.	How can we meet projected water needs given current trends in water use and population growth?	Planners extrapolate from current consumption patterns to determine future "requirements" and then locate and develop new sources of supply to meet this projected demand.	Construction of dams, pipelines, canals, wells, desalination systems, and interbasin transfers, where necessary.
Demand Management	Economics	Policies based on short-term cost-benefit calculations.	How can we reduce needs for water to conserve the resource, save money and reduce environmental impacts?	Planners incorporate efficiency and information programs together with improved pricing patterns to maximize use of existing infrastructure. Increasing capacity is only one option among others in a least-cost approach.	Efficiency gains through technical fixes and consumer education.
Soft Path	Multi-disciplinary	Policies based on stakeholder consultation and political review.	How can we deliver services currently provided by water in ways that recognize the need for economic, social and ecological sustainability?	Planners model a sustainable future state for water use with attention to long-term economic and social prosperity. They then "backcast" to devise a feasible and desirable path to reach that state. Ecological sustainability is fundamental to all economic, political and socio-cultural choices.	Options to reduce water use through innovation, conservation, water reallocation and changing patterns of use and re-use. More water is left *in situ*.



Source: **The Soft Path for Water in a Nutshell** (FOE, 2006)

Water soft paths are a vision, an analytical method, and a planning tool. The method is designed to explore alternative routes to move from the vision to practical application.

describe the future we want and figure out how to get there from here. Called "backcasting," this process is another core principle of a water soft path.

Under a water soft path regime, the role of management shifts from building and maintaining water supply infrastructure to providing water services, such as new forms of sanitation, drought-resistant landscapes, urban redesign for conservation, water reuse and recycling, and new methods for rain-fed agriculture.

The water soft path is both a concept and a method. Many people accept it as an ideal that moves us closer to sustainability. However, few people recognize that methods needed to transform the soft path from "eco-dreaming" to practical applications already exist. These methods must be refined, but studies undertaken by Amory Lovins at the Rocky Mountain Institute in the US, who created soft energy paths, demonstrate that experience gained through analysis of alternative energy strategies can be adapted to freshwater.

The recently completed research on water soft paths in Canada, as described in this issue of *Alternatives*, explores what water soft path policies might achieve in Canada. Feasibility studies undertaken at three scales, on a watershed scale in Nova Scotia, on a provincial scale in Ontario and on an urban scale in British Columbia, illustrate the opportunities and challenges. They are the first set of comprehensive water soft path studies completed anywhere in the world. Rather than being definitive, the results are indicative. However, they demonstrate that the goal of sustainable development for freshwater is within our grasp in Canada. Where there's a way, oftentimes there's a will.

Oliver M. Brandes leads the Water Sustainability Project at the POLIS Project on Ecological Governance at the University of Victoria, BC. David B. Brooks has been associated with Friends of the Earth Canada since its founding, and now serves as director of research.

Alternatives is grateful to Policy Research Initiative for permission to adapt an article that originally appeared in the May 2006 issue of ***Horizons****, a Government of Canada publication.*

For further reading, see "Water Resources" on page 28.

Community Paths

Investigating BC's urban water use

Purpose

1. To determine if water soft path planning could enable an urban centre to avoid obtaining new water supplies until 2050.
2. To study whether a water soft path could be effectively applied on an urban centre basis.

Method

Using existing water use and population growth data, this study investigated future water use under three scenarios: business-as-usual, demand management and a water soft path. Results for the three scenarios were calculated for a general urban centre with a base population of 200,000 in 2005 and 300,000 in 2050. The water reduction policy and technology specifics for each of the scenarios were developed through water conservation and efficiency analyses associated with several urban centres including the Town of Oliver in the Okanagan Basin and The Capital Regional District (Victoria) in British Columbia.

Outcome

The goal of no new water until 2050 in an urban centre is achievable, even under conditions of significant population growth. This water soft path analysis is proof that our past urban water-use patterns and habits need not dictate our future. Action, however, must begin today.

Findings

Business-as-usual

By 2050, under the business-as-usual scenario, the increase in water use would mimic population growth, adding up to approximately 68 million cubic metres (Mm^3) of water per year. This amount reflects no growth in use on a per capita basis, but incorporates a 50 per cent increase in population over the 45-year period.

Demand management

The demand management scenario demonstrates the significant potential of readily available technologies and practices. In our generalized urban case, this scenario results in water savings of approximately 24 per cent, which amounts to over 16 Mm^3 per year by 2050 as compared with the business-as-usual case. In this scenario, water savings were realized primarily through increased use of low-flow and dual-flush toilets, efficient showers and faucets, and water-saving clothes washers. While significant, these savings are not enough to offset the population growth.

Water soft path

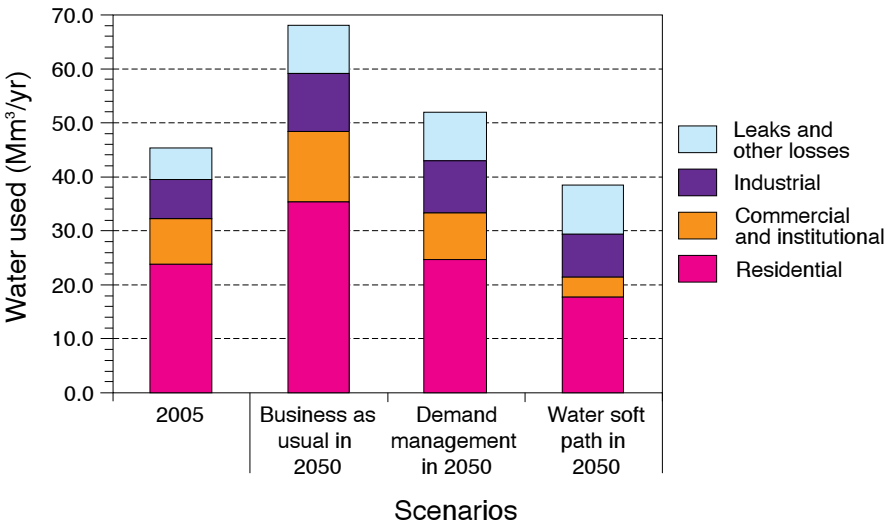
Under the water soft path scenario, water savings of almost 44 per cent are possible, resulting in overall savings of just under 30 Mm^3 of water per year compared with the business-as-usual case. This is a significant savings and would mean approximately 7 Mm^3 less water being used in 2050 than today, based on average per capita water use as determined by Environment Canada. Thus a population growth of almost 75 per cent could be offset through conservation and efficiency.

The water soft path scenario builds on the initial water savings developed in the demand management scenario. It involves adoption of more advanced technologies and practices than the demand management scenario, including composting toilets, waterless urinals, xeriscaping, widespread reuse, recycling and rainwater harvesting.

Oliver M. Brandes leads the Water Sustainability Project at the POLIS Project on Ecological Governance at the University of Victoria, BC.
Tony Maas is a master's candidate in the School of Planning at the University of Waterloo and a Research Associate at POLIS.

For more information, go to **www.foecanada.org**

Three Scenarios for Community Water Use in BC



Water demand management alone is not enough to offset the effects of population growth.

Study Results / Lisa Isaacman and Graham R. Daborn

Watershed Paths

Application in the Annapolis Valley, NS

Purpose

1. To determine if water soft path planning could enable the Annapolis Valley to avoid obtaining new water supplies or even better, achieve a 50 per cent reduction from current use, by 2030.
2. To study whether a water soft path could be effectively applied on a watershed basis.

Method

Using existing water-use data, and educated assumptions when data were unavailable, this study investigated future water use to 2030 in the Annapolis Valley under three scenarios: business-as-usual, demand management and a water soft path.

Outcome

The water soft path could reduce annual water use to 55 per cent below current levels. Furthermore, from ecological and integrated-management perspectives, the watershed is a suitable and effective scale for application of water soft path analyses. However, the often variable nature of local social, economic and political conditions across a watershed and the scarcity of watershed-based management systems in Canada may complicate the process of applying a water soft path approach on a watershed basis.

Findings

In an average year, total annual water supply (from both surface and groundwater) to the Annapolis Valley averages 1500 million cubic metres (Mm^3), with less than 10 per cent arriving between June and August when demand is highest. Assuming 75 per cent of surface and 50 per cent of groundwater need to remain *in situ* for ecosystem services, about 500 Mm^3 could theoretically be withdrawn sustainably on an annual basis.

At 25 Mm^3, current total annual water use in the Annapolis Valley is estimated to be about five per cent of the sustainable take. Approximately 50 per cent of this total occurs during summer. While there appears to be a wide margin between the amount of water available and that taken, withdrawals have nonetheless exceeded the sustainable take in 12 years of the last 40 during the summer and three times on an annual basis.

Agriculture is the largest annual water user with over 36 per cent of total withdrawals. The residential sector is a close second at 34 per cent, followed by the commercial (13 per cent) and industrial (12 per cent) sectors, municipal systems losses (three per cent) and golf courses (two per cent). Golf courses are significant because together with agriculture they account for almost two-thirds of total withdrawals during the intense summer season. Some 71 per cent of the annual withdrawal and 43 per cent of the summer take come from groundwater, the primary source for the residential, commercial and industrial sectors.

Business-as-usual

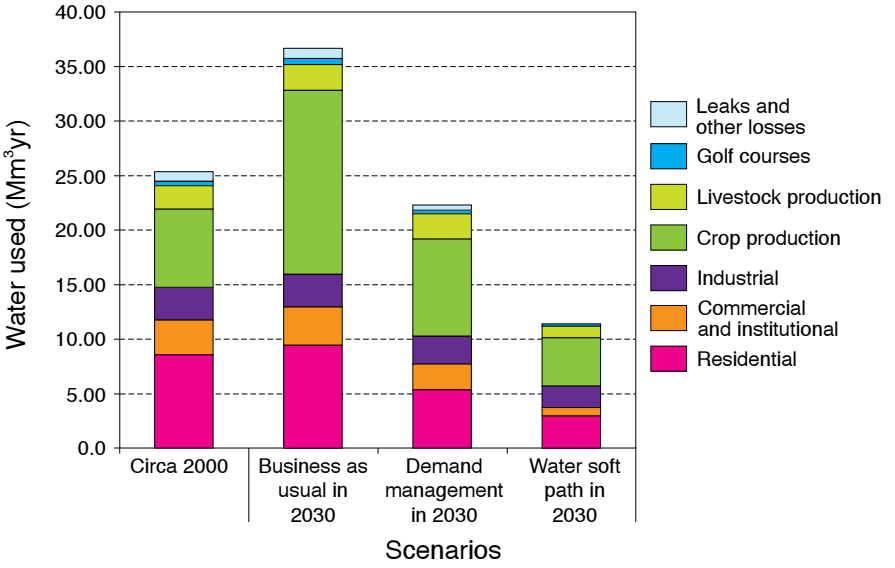
When projected to 2030, current trends suggest the total annual water withdrawal could exceed 36 Mm^3, which is about a 45 per cent increase over the present level. Summer withdrawals, however, would grow by about 80 per cent. The highest growth in water use (more than 100 per cent) is expected for crop production, with much lower increases (7 to 35 per cent) in most other sectors. These forecasts indicate that under business-as-usual conditions, surface water availability would be inadequate to meet annual demand in at least one year in 12, and nearly every other year (44 per cent of the time) during the summer. Groundwater availability would fail to meet annual demand two years in five.

Demand management

Under a demand management scenario, annual withdrawal could be about 22 Mm^3, an overall reduction of 40 per cent per year, and a 48 per cent reduction in

Continued on page 17.

Three Scenarios for Water Use in the Annapolis Valley



Water soft paths show how humid regions can make major reductions in water use.

Study Results / Paul A. Kay, Elizabeth Hendriks and Nabeela Rahman

Provincial Paths

Planning for Ontario's future

Purpose

1. To determine if water soft path planning could enable the province of Ontario to avoid tapping into new sources of water by 2031.
2. To study whether a water soft path could be effectively applied on a province-wide basis.

Method

Using existing water-use and population growth data, this study investigated future water use under three scenarios: business-as-usual, demand management and a water soft path.

Outcome

It would be daunting for Ontario to totally avoid using new sources of water. Nevertheless, recognizing the uncertainty of the data and assumptions, projections suggest the province might achieve a goal of no greater water use than today if it follows a water soft path.

The provinces are an appropriate scale for policy in support of sustainable water use because they constitutionally have jurisdiction over most aspects of most water.

Findings

The Municipal Sector

Municipal water data comprise residential, commercial, institutional, recreational and municipal uses, plus non-revenue uses (leakage, losses and other unaccounted water). In 2004, according to the Ontario Ministry of Finance, about 92 per cent of Ontario's 12.4 million residents lived in municipalities with a population of 1000 or more. With this highly urban and growing population, municipal water use likely far exceeds the 1880 million cubic metres (Mm^3) per year measured in 2001.

Business-as-usual

Under a business-as-usual scenario, water use is projected to grow to about 2500 Mm^3 per year in 2031, to accommodate a projected population increase of 32 per cent anticipated over the same time period.

Demand management

Demand management could reduce municipal water use to a level that is almost 20 per cent less than present use.

The effect of population growth, however, might outweigh savings resulting from demand management, especially in the residential sector.

Indoor use would decline due to increased adoption of efficient appliances, but outdoor water use would remain almost unchanged despite efficiencies.

Industrial and commercial use would decline markedly, due to changes to outdoor landscaping and indoor efficiencies.

Infrastructure improvements would result in only a minor decrease in water loss, but it would be much improved over the business-as-usual scenario.

Water soft path

The water soft path could reduce municipal water use to a level that is almost 50 per cent lower than present use, an additional 30 per cent saving as compared to the demand management scenario.

Efficiencies and conservation would outweigh the effect of growth.

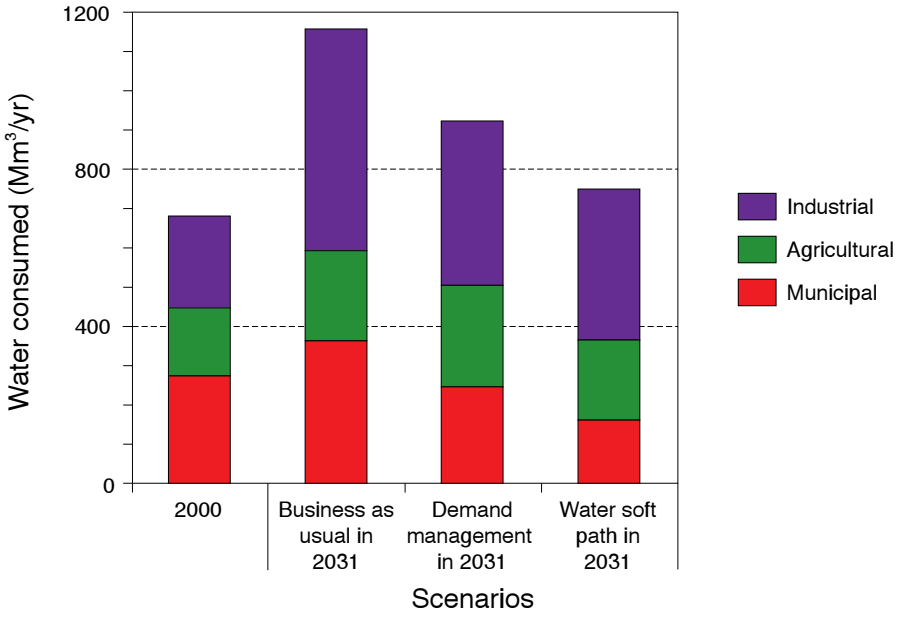
Residential indoor use would be reduced by about 50 per cent, and outdoor use would be down by 25 per cent.

Leakage would be about two-thirds of current levels and half the business-as-usual value.

The Agricultural Sector

Agriculture, Ontario's second largest economic sector, accounts for 20 per cent of the province's total consumptive use. Rapid urban growth is expected to increase the demand for water for food production and irrigation will likely increase as farmers attempt to raise productivity on a dwindling supply of

Three Scenarios for Water Use in Ontario



Municipal water use shrinks by almost 50 per cent in the water soft path scenario.

Graphs redrawn by Barry Levely

agricultural land. Cultivation of water-intensive discretionary crops such as sod and nursery stock is also anticipated to rise.

Business-as-usual
Agricultural water consumption would increase to 230 from 174 Mm^3 per year by 2031.

Demand management
Total water consumption would increase by about 47 per cent above current levels and 11 per cent above the business-as-usual scenario, due mainly to an assumed major expansion of irrigation.

Water soft path
By using the best available efficiencies for irrigation, without reducing the amount of land irrigated, a water soft path would result in total water use that is estimated to be 17 per cent above current levels, but 14 per cent below the business-as-usual scenario. Reduced tobacco production and less demand for sod brought about by a diminished focus on lawns would maintain water use in 2031 at current levels.

The Industrial Sector

Ontario accounted for one-half of the national total industrial intake of water and more than one-third of national industrial consumptive use in 1996.

Business-as-usual
Projected consumption, assuming population growth and economic expansion, would grow to between 400 and 730 Mm^3 per year by 2031, from 233 Mm^3 per year in 2001.

Demand management
Many industries have deployed efficiency measures such that recirculated water is already a larger component of gross use than is fresh intake. If these improvements continue, the demand management scenario would result in consumption that is about 25 per cent less than business-as-usual projections. The amounts consumed, however, would be at least 30 per cent greater than at present.

Water soft path
Modest enhancements would result in water soft path projections of consumption that are one-third to one-half less than in the business-as-usual case. Consumption, however, would be at least 16 per cent above present levels.

Because of their large size and high water use, it is important that the transportation equipment, and paper and allied products sectors adopt water soft path principles if Ontario is to move toward a more sustainable system of water management.

Lessons Learned

1. Data availability is a major barrier. Ontario's new permit-to-take water procedures may eventually provide an archive of water-use data.
2. Since the water crisis in Walkerton, Ontario that killed 21 people, the province has focused on water quality as opposed to quantity.
3. It is difficult to shake the ingrained perception that water quantity is not an issue.
4. Ontario lacks a foundational water policy to guide progress, and there is poor co-ordination among the plethora of jurisdictions.
5. Future water soft path investigations should be at a smaller scale (municipal, drainage basin or industry), for which specific efficiency and conservation measures can be identified.
6. With detailed, small-scale studies in place, aggregation to the provincial scale would be more accurate.

Paul A. Kay is chair of the Department of Environment and Resource Studies at the University of Waterloo. Elizabeth Hendriks and Nabeela Rahman are master's candidates in Environment and Resource Studies at the University of Waterloo.

For more information, go to **www.foecanada.org**

"*Watershed Paths*" *from page 15*

summer as compared to business-as-usual. The Annapolis Valley could still experience periods with insufficient availability, however, especially given climate change forecasts that suggest precipitation will become higher in the fall, winter and spring, but lower during the critical growing season.

In addition to policy and regulatory changes, improved monitoring and enforcement, financial and technical support, and education programs, achieving the reductions in water use described above would require the widespread adoption of efficient technologies and practices such as the following:

- high-efficiency technologies (e.g. low-flow toilets and fixtures; cooling/heating systems) and practices (e.g. crop, golf course, lawn irrigation, industrial/agricultural procedures);
- drip or trickle irrigation or high-efficiency sprinklers;
- repairing leaks (especially municipal water mains); and
- capping artesian wells.

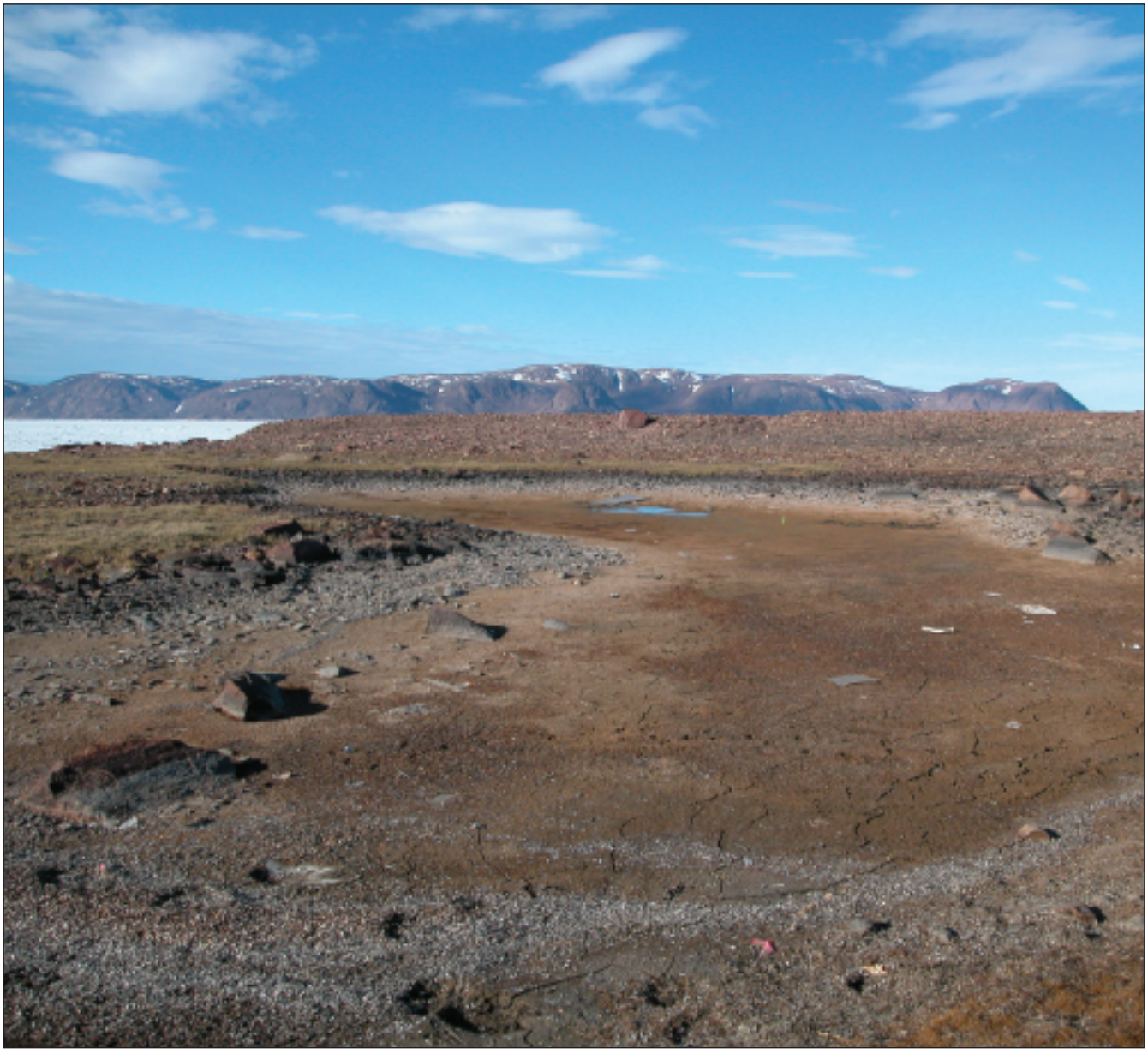
Water soft path
The water soft path would result in an annual demand of about 11 Mm^3 (only one-third of the business-as-usual estimate), which is 55 and 54 per cent below current annual and summer demand, respectively. With this improvement in use, the likelihood of insufficient supply in the region is much reduced when compared to the business-as-usual and demand management scenarios.

To achieve this level would require the widespread adoption of basic demand management measures, as well as the significant uptake of one or more of the following in each sector:

- waterless technologies and practices (e.g. toilets, cooling systems, industrial cleaning);
- rainwater and runoff storage (e.g. crop and golf course irrigation, livestock, cleaning, industrial processes); and
- water and wastewater recycling/reuse (e.g. industrial, dairy, and greenhouse processes and cleaning).

Graham R. Daborn is director of the Arthur Irving Academy for the Environment at Acadia University and co-chair of the Research Management Committee, Canadian Water Network. Lisa Isaacman is a conservation scientist whose primary interests include habitat protection, wildlife conservation and environmental stewardship.

For more information, go to **www.foecanada.org**



M.S.V. Douglas

High Arctic ponds are like the miner's canaries of the planet because they are particularly sensitive to the effects of climatic and other environmental changes. Queen's University researchers John Smol and Marianne Douglas have been monitoring 40 ponds in the Cape Herschel area of east-central Ellesmere Island since 1983. A trend of declining water levels was considered alarming in the 1990s, but Smol and Douglas say Camp Pond (pictured above on July 11, 2006) and several other ponds have now crossed the final ecological threshold – they're dry. Radiocarbon dates indicate that these "lakes" are at least 6000 years old. Smol and Douglas' startling conclusions have just been published in the ***Proceedings of the National Academy of Sciences.***

Crisis? What Crisis?

Susan Holtz

Water soft path proponents swim against a current of sparse data, skeptical citizens and policy barriers.

THE SINGLE most important characteristic of a water soft path is that it is about sustainability as a new, additional and explicit goal for water management. Unlike traditional water planning, the soft path takes into account the water requirements for *in situ* functions of the natural resource. This new perspective acknowledges the vital importance of maintaining ecological "services" like nutrient cycling and aquatic habitat, as well as on-site uses such as boating and hydroelectric power production. However, even in a relatively water-rich country such as Canada, the capacity of the resource to sustain these functions can be compromised before water shortages for agriculture, industry and domestic use become acute. At some point, therefore, water withdrawals and diversion will need to be limited. This fact drives the water soft path.

Studies presented in *The Soft Path for Water in a Nutshell* (FOE 2006) and described in this issue of *Alternatives* indicate that, especially in seasonal low-flow periods, shortfalls of replenishable water throughout much of southern Canada are nearer at hand than most people appreciate. In many other parts of the world, such shortfalls are already reality.

In addition to telling us something of the state of our water resources, the studies in this report demonstrate that with a soft path approach, sustainable water use in Canada is within reach. The soft path provides the new tools needed to achieve this: backcasting, matching water quality to water needs, and treating water as a service rather than as a requirement. But know-how is not enough. Implementation of a water soft path also requires policy change in water management, change that affects decision making by water utilities, and planning and other agencies at all levels of government.

Policy by definition involves establishing the overall direction that is taken on some issue. However, as listed in "Barriers Along the Path," there are a number of hurdles to overcome if decision makers and the public are to be convinced of the need for change.

Policy making by default

Policy making by default is the first obstacle that water soft path advocates must surmount. Policy choices aren't always deliberately framed by politicians and political parties. Sometimes corporate, bureaucratic or administrative decisions can limit available options for decades, effectively creating public policy. Or policy can be set by not making decisions even when there is reason to rethink alternatives and priorities. Canada's decades-long failure to develop a climate change strategy is a case in point. With water policy, business-as-usual decisions, especially about infrastructure, can set water management priorities for years to come, keeping water soft path ideas on the margins. Without ever being actively rejected, a water soft path approach could be sidelined indefinitely.

Paradoxically, with a water soft path, change can be even more difficult because this approach builds on, rather than rejects, current aspects of water management. Today's model for delivering water services in Canada is still dominated by the public health and technical achievements of the past century. In many places, demand management programs have been added. But safe water systems and demand management strategies are incorporated into a water soft path. As a result, a soft path approach may not appear dramatically differ-

Barriers Along the Path

A NUMBER of barriers that might impede progress or success of a water soft path include the following:

Attitude and perception

Attitudinal and perceptual barriers result from the way in which individuals or groups perceive and value water conservation initiatives. As water use and conservation is often a political issue, information may be communicated to the public by interested parties, each with their own bias. Furthermore, because Canada is perceived to have vast quantities of water, it can be difficult to convince people to conserve. Similarly, because water soft paths are unfamiliar to many water managers, they may not believe that this approach is a viable option.

Organization and administration

Organizational and administrative barriers occur when conflicting responsibilities inhibit implementation of various conservation initiatives. For instance, a municipality may be required to provide an uninterrupted supply of freshwater for residents; farmers may need increasing amounts of groundwater for irrigation; and conservation groups might want to conserve water for ecological functions. Unless these groups have a forum in which they can work together, consensus will be difficult.

Financial and other resources

Resource-related and financial barriers occur when insufficient resources are allocated to water conservation, and when real-world complexities are poorly reflected in economic models. The economic benefits of water soft paths may not be fully valued in traditional cost-benefit approaches. The complexities excluded from an analysis should be clearly stated along with the reasoning for the exclusion.

Data and information

Data and informational barriers are a significant challenge to managing Canada's water resources. Poor quality and non-existent water data are problems for implementation of a water soft path, as are non-standardized data.

Policy, regulations and governance

Policy, regulatory and governance barriers come about in the absence of the integrated planning, stakeholder participation and departmental capacity needed to implement water soft paths. These barriers often result because political terms tend to be shorter than the planning periods needed to build new water infrastructure, for example. Furthermore, because a water soft path is more of an extension of demand management than a deviation from it, policy makers may stick with the status quo.

Sarah Jordaan is a PhD student in Environmental Design at the University of Calgary, focusing on lifecycle assessment and its application to land use. Carla Stevens is an environmental consultant in Canmore, Alberta, specializing in landscape ecology, and integrated land use and water management.

For a complete report, please visit **www.foecanada.org** and click on the Universal Water Security button.

ent, making the attention and commitment needed for its implementation harder to gain.

If there is to be progress on water soft path policies, it will require an understanding both of what can be done differently and why things need to change. Knowing who the actors are, and how they can shift policy direction is also important if water management is to move toward a water soft path and sustainability.

Policy that limits use

The primary goal of traditional business-as-usual water planning is to provide the infrastructure to tap, treat and distribute water so that people have a safe, adequate water supply for all their perceived needs. For its part, demand management as a distinct approach recognizes that it's usually cheaper to improve efficiency and conserve than to rapidly develop new supply sources and infrastructure. Unlike a water soft path, however, both business-as-usual and demand management fail to require actual limits on the resource itself, or to put limits on human uses of it, or on construction of new water infrastructure.

As a pragmatic first objective, water soft paths in Canada propose that no additional supply infrastructure should be constructed until some future date that is at least 20 to 50 years hence. Politicians, bureaucrats and communities thus have a reasonable planning period to reach a target that approximates the limits that might be needed for achieving ecological goals and sustainable human use.

A truly sustainable approach to water management must reshape the human activities that affect water use. Given Canada's growing population, limiting the infrastructure needed to make water available will mean personal per capita usage needs to fall. Furthermore, businesses, institutions, industry and agriculture must also reduce their demand. These changes can have challenging societal implications. The public must understand and support water soft path policies and the social and economic changes their implementation will require. Among other things this necessitates transparent decision making, regular feedback, equitable water allocation mechanisms and pricing, and economically sustainable ways to maintain the water infrastructure.

Great Potential in Pulp and Paper

ACCORDING to the Canadian Council of Ministers of the Environment, Canada's pulp and paper industry is the country's largest single industrial user of freshwater. As such, this industry could have a significant role in reducing Canada's water use.

The Forest Products Association of Canada reports that Canadian mills reduced their water use by 34 per cent between 1989 and 2003, despite a 30 per cent increase in production. A key industry expert attributes this improvement to technical efficiencies applied to pulping processes. Industry reports suggest there will continue to be a trend towards further water savings through the adoption of improved process controls, water reuse efforts and other initiatives. Best available technologies include zero-effluent mills and closed-loop systems. With these technologies, water intake can be as low as two cubic metres per tonne of product, since use is limited to that which is needed to replace water that is either incorporated into the product or lost to evaporation. This compares with traditional pulping processes that vary in their water use from about 30 cubic metres per tonne to over 100 cubic metres per tonne.

A number of issues make it difficult to determine how much water could be saved if the pulp and paper industry were to adopt the water soft path. The availability and quality of water-use data vary considerably from mill to mill because of inconsistent or non-existent reporting protocols and as a result of site-specific features such as climate and geography. As well, the different pulping processes – chemical, mechanical and chemo-mechanical – vary significantly in their water and energy requirements. Chemical pulping uses more water but less energy while producing a lower-grade pulp. Mechanical pulping uses less water but much more energy while producing a higher-grade pulp.

Technology advancement is essential to water efficiency, but on its own will not fully realize the water soft path. Literature review and interviews indicate that economic drivers, policy and regulation, and changes to corporate attitudes are also imperative if the water soft path is to be successfully implemented. If these barriers were overcome, a water soft path could dramatically reduce water use and increase innovation within a boom and bust industry, such as pulp and paper.

Elizabeth Hendriks is a master's candidate in Environment and Resource Studies at the University of Waterloo.

Land use and land-use planning

There are also a raft of institutional issues that affect implementation of a water soft path. Probably the most crucial institutional reform concerns the relationship between water management and land-use planning. Water planning currently follows from decisions about land use and economic development – plan a new subdivision and municipal engineers will see that sufficient water is available. But if construction of new infrastructure is to be avoided, water management must sometimes override these matters – if water is not available in an area, perhaps a subdivision cannot be built there.

As a result, planning departments will need to employ new information and techniques, and address different issues. Municipal, provincial and federal governments will also require redefined or additional positions and programs to enhance supporting activities in environment, economic development and water management agencies.

Evidence from water soft path studies indicates that although there are important initiatives that senior levels of government must undertake, most of the critical action is at the municipal level. As a result, rather than a single, grand design for the whole country at once, a successful national water soft path is like piecing together a patchwork quilt.

Municipal governments, including watershed authorities such as those in Ontario, need to mandate a water conservation focus in their land-use and other planning, and adjust their budgets and staffing levels accordingly. Local water utilities, which are responsible for planning and building infrastructure, must develop scenarios, targets and implementation strategies based on sustainability. Conservation and demand management programs will need to incorporate both incentives and tough measures that include municipal by-laws and water pricing.

Provincial and federal responsibilities

Given that provincial governments have the main responsibility for protection and knowledge of the resource, they will need to review their policies on well-drilling and water takings, introduce stronger measures

Virtual Water Trading

A COUNTRY THAT TRADES water-intensive commodities is actually trading water in a virtual form. A nation's "water footprint" is thus the sum of domestic water use plus its net virtual water in trade.

Agriculture is one of a number of industries through which Canada trades virtual water. This sector, according to Agriculture and Agri-Food Canada, consumes 70 per cent of the water it withdraws. And while agriculture accounts for only nine per cent of the nation's water take, this number is on the rise. Facilitated by the North American Free Trade Agreement, agri-food export values have increased from $15.8-billion in 1993 to $27.7-billion in 2006 (a 76 per cent increase). Perhaps the most significant growth by value has been in the export of meat and meat offal, whose trade soared by almost $3-billion (230 per cent increase) between 1993 and 2002. The meat industry, it seems, is extremely water intensive. For instance, it accounted for 30 per cent of Ontario's total agricultural water use in 2001.

In 2005, Canada sent 380,000 tonnes of beef and veal products to the US, its largest export market. This amount represents approximately 3.7 billion cubic metres of virtual water. At the same time, the US shipped about 48,000 tonnes of beef and veal products into Canada, which is equivalent to about 4.6 million cubic metres of virtual water. Thus, this component of the livestock trade represents an 80-fold water imbalance for Canada. Although this virtual water export is a small part of Canada's water footprint, it comes primarily from the water-deficient Prairie provinces.

This means the US, due to free-market rules, is able to offset its water requirements in the livestock sector by importing meat products from Canada. According to J.A. Allan, a geography professor at King's College London, the movement of virtual water in this way can address regional water disparities since it is more cost-effective to move virtual water associated, for example, with meat exports, than to transfer bulk water. Nonetheless, this trade in virtual water puts pressure on Canada's natural resources and raises the nation's water footprint.

Nabeela Rahman is a master's candidate in Environment and Resource Studies at the University of Waterloo.

to protect aquatic habitat, and develop their information base and enforcement capabilities. Provincial governments could also look for innovative ways to provide leadership, such as setting up a water commissioner's office to co-ordinate water planning. They could develop guidelines for water rates based on marginal, full-cost pricing, and even require public utilities boards to review water pricing, with legislative direction to consider fairness, cost recovery and conservation.

Finally, the federal government should apply the water soft path approach to planning and operations in areas under its jurisdiction: water on First Nation reserves, in the North and in national parks and other federal lands. In its role in supporting technology development and environmental science and research, the federal government could designate resources for the water soft path.

Overcoming the critical barriers

Making any change that shifts policy direction is seldom easy. To bring about a water soft path, however, three areas stand out as needing an exceptionally creative, determined effort.

First, realistic water pricing is fundamental for a water soft path and probably its hardest sell. Water metering and full-cost accounting and pricing are essential to give water utilities a solid basis for analyzing and introducing demand management programs,

Waterless Lunch

OVER 70 per cent of the world's freshwater is used in agriculture, most for irrigation. As a result, it comes as no surprise that it takes a huge amount of water to produce food for a typical North American (between 2000 and 5000 litres of water per day). This quantity dwarfs daily personal needs of two to five litres for drinking and the 50 or so litres for washing and other practices. As a rough generalization, it takes one litre of water to grow every calorie of food.

How much water could be saved if we changed our eating patterns? The typical answer is that we could cut water use to produce food by 50 to 90 per cent. However, more careful calculations that compare apples with apples – or, more accurately, protein with protein and carbohydrate with carbohydrate – suggest that potential gains are more modest than generally thought.

We calculated water requirements for lunch and supper for three diets, each of which was nutritionally balanced and contained roughly the same number of calories: the diet of a typical North American, a semi-vegetarian diet (some poultry and fish) and an ovo-lacto vegetarian diet. Our results show that it takes less water to produce both the semi-vegetarian diet (860-3150 litres per person-day) and the ovo-lacto vegetarian diet (780 - 3670 litres) than most typical diets (1450 - 5490 litres), but by factors closer to two or three than ten.

We learned that water use is dependent on different foods within a type of diet (typical, semi-vegetarian and ovo-lacto vegetarian) rather than the diet itself. This explains the wide ranges for each diet, and it means that becoming a vegetarian, for example, will not necessarily save water. The potential to reduce water use exists, but one must choose foods carefully. Yet making the correct choices requires more analysis. For one thing, our study focused on water used in food production but neglected that used in packaging, transportation and other aspects of the food industry. More importantly, we could not distinguish between rain-fed and irrigated agriculture.

In general, the best way to save water through diet is to eat food grown on farms large enough to be efficient but close enough to be sold in farmers' markets. And if you prefer animal protein, look for meat that is range-fed, and, for beef in particular, finished on grass rather than grain.

Water Use By Selected Crops (m^3/tonne)

Selected grains		Selected veggies	
Barley	3560	Cabbage	1640
Wheat	3740	Green Beans	2200
Maize (corn)	5720	Potato	3290
Oats	5790	Soybean	3400
		Carrots	4220
		Onions	4450
		Cauliflower	4720

Source: Hoekstra, A.Y. and P.Q. Hung. 2002. "A Quantification of Virtual Water Flows between Nations in Relation to International Crop Trade." ***Value of Water Research Report Series No.11*** *(Delft, The Netherlands: IHE Delft).*

David B. Brooks has been associated with Friends of the Earth Canada since its founding, and now serves as director of research. Anja Grauenhorst is a student in Social Science Studies at University of Mannheim, Germany.

Ice Rinks Score Too

RELATIVE TO SWIMMING POOLS, ice rinks are water misers. It takes about 1158 cubic metres of water to build and maintain the ice surface for a year at an indoor rink – about half the amount of water it takes to fill one Olympic-sized swimming pool. Nonetheless, presuming 80 per cent of Ontario's 736 indoor arenas have a six-month season, their provincial total water use is on the order of half a million cubic metres per year, the equivalent of some 200 Olympic pools.

Though hardly the province's largest water consumers, skating arenas have room for improvement. If most of the ice shaved from the rink's surface is deposited outside the rink, and allowed to melt and be re-absorbed into groundwater, consumption may be small. But if the melt-water contains sweat, blood and metal shavings, it may be deemed hazardous. In this case, it requires special treatment and cannot be allowed to re-enter the hydrologic cycle through reabsorption. As a result, reducing water use is critical.

One conservation method is to use purified water since it makes harder ice, thereby allowing the sheet to be thinner and resurfacing less frequent. Since temperature and humidity levels in the arena affect the quality of the ice, their control can also result in reduced water use. Though they are expensive, some resurfacing machines use less water because they recycle shaved ice. And melt-water doesn't have to be discarded; it can be used for irrigation or in flush toilets. Saving and treating melted water for building new ice would close the water loop. Furthermore, if water is in tight supply, perhaps communities will have to forego ice skating during the summer.

Paul A. Kay is chair of the Department of Environment and Resource Studies at the University of Waterloo.

and domestic users reason to participate in them. Such pricing also provides farmers and commercial, institutional and industrial customers with the business rationale they need to redesign their operations for radical water use reduction. Complicating matters is the tendency of the public and politicians to resist anything that requires an increase in water rates. And activist campaigns for water as a human right and against privatizing water treatment may encourage an attitude of entitlement toward water use and hostility to putting any price on it.

Second, belief and motivation are underrated as factors that hinder application of the water soft path approach. Even with water prices that signal otherwise, the widespread assumption that water is abundant in Canada is likely to persist for some time, especially in urban areas where water simply comes from the tap. Sophisticated social marketing programs about water conservation can get individual users to change their behaviour. But moving politicians to alter institutional structures and policy frameworks generally requires a perception that there is a public crisis. Information programs about water resources and the implications of current use patterns must be innovative and compelling in order to reach the public and encourage officials to implement institutional change.

Finally, there is the challenge of inadequate and poor quality data. As water soft path studies make crystal clear, limited data and monitoring for both the resource base and water use allow only a sketchy picture of the present situation. This lack of information not only hampers water soft path planning, but also discourages any sense of urgency. Revitalizing state of environment reporting in Canada is one initiative that could motivate agencies to improve their data collection and analysis.

The good news

The good news is that changes required for water soft paths are not unprecedented. The 1970s oil price shocks resulted in re-organized federal and provincial energy departments and new agencies dedicated to energy conservation. New analyses, policies and programs arrived on their heels, and despite the subsequent weakening of key drivers – high energy prices and energy security worries – many developments in the energy planning infrastructure survive today.

Although there is no water crisis comparable to the 1970s upheaval in energy prices and supply, growing concern about the environment is creating a political window of opportunity in Canada. Links with other issues, such as the impact of climate change on agriculture and food security, the challenge of protecting source water, and the detection in drinking water of pharmaceuticals and other contaminants could provide a springboard to broaden water-related reforms into water soft path policies. Implementation of a soft water path may require that its proponents swim against the current for a time, but with determination, inventiveness and foresight, certainly the tide can change.

Susan Holtz was one of the original researchers for the Canadian Soft Energy Path Study, and is currently the senior policy analyst for the Canadian Institute for Environmental Law and Policy (CIELAP).