

Charging for Water Use in Canada

A WORKBOOK OF THE CENTRAL PRINCIPLES, KEY QUESTIONS, AND INITIAL STEPS

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Executive Summary

Introduction

Canada's abundant water is essential to virtually all aspects of the economy, and it also supports diverse and globally significant ecosystems. In addition to its economic and environmental importance, Canadians are passionate about the social and cultural significance of water.

At the same time, many Canadians are apprehensive about the current and future state of the country's water supply. In response to a range of global trends such as climate change, population growth, continued urbanization, expansion of irrigated agriculture, and natural resource development, attention is becoming increasingly focused on the potential of various financial incentives and market-based mechanisms¹—including water charges—to improve water resources management policies and practices.

The Project

In late 2010, the Canada West Foundation drafted a discussion paper on charging for water use in Canada. This paper outlined the rationale for and complexities of pricing water. In early 2011, the discussion paper was sent to a group of 42 water policy experts from Australia, Canada and the US. This document seeks to describe where there was general consensus amongst our expert panel and provides a solid “workbook” that outlines the questions policymakers must answer in order to build a comprehensive water charging system.

Key Definitions

Price vs. Charge: A “price” for any good, service or resource can only be arrived at through the interaction of supply and demand in a properly functioning and competitive market. When it comes to the concept of water pricing, often what is being referred to is a financial charge (an administered or regulated price) rather than a market price. In the absence of a market, such charges will imperfectly reflect economic value. In short, market prices are economically determined while any other price is politically determined. To avoid confusion, we use the term “charge” to reflect any “price” not determined by market force.

Water Use Charge: A water use charge is a financial mechanism that attaches a “charge” on all water used or withdrawn from a water source. This concept of water use charging goes beyond the familiar practice of Canadian municipal water utilities and other water agencies (e.g., irrigation districts) where water charges are typically employed to recover the costs of operating and maintaining water and wastewater infrastructure—the water itself is essentially free. This broader concept of water use charges an additional amount for the *use* of water itself (which can include diversions, consumption, effluent discharge, storage and instream uses).

¹ See glossary for definitions.

Traditional Water Management and Allocation

Three different approaches can be taken to manage and allocate scarce resources. The first (and traditional) approach is “command and control,” where governments use legislation and regulation to direct who, when, where, why and how certain goods, services and resources are to be used. The second approach employs a competitive market to allocate resources and manage scarcity. Here the laws of supply and demand intersect to establish a “market price.” The third approach is a hybrid wherein a functioning market operates under government legislation and regulation. The current discussion over financial incentives and market-based mechanisms in water resources management is all about supplementing the traditional command and control approach with various financial measures.

Why Charge for Using Water?

The majority of the water policy experts consulted by the Canada West Foundation felt that water use charges should play a role in water resources management in Canada. Overall, the expert panel agreed that charging for water use can:

- help limit or moderate demand;
- increase the supply of water available;
- be flexible and promote choice;
- lever a multitude of important goals and objectives, such as stimulating conservation, incenting pollution reduction, ensuring future cost savings for governments and helping to guarantee sustainability for future generations;
- help fund a more scientific and rational system of water resources management;
- allow the cost of human impacts on water resources to be better accounted for; and
- be accepted by Canadians, who are already accustomed to receiving water bills.

Although water charges do currently exist in Canada, they are often not significant enough to effectively communicate the value of water. Many experts contended that the value and importance of water cannot be recognized or understood when there are limited financial consequences associated with its use.

The Challenges of Charging for Water Use

The use of financial incentives and market-based mechanisms for water management may be one of the most contentious issues in the water policy world. The debate over charging for water is a complex and multi-dimensional issue: there is a wide array of choices open to policymakers and often a lack of understanding of how these choices might impact water and various water users. In addition, it can be difficult to arrive at the “right” financial charge, which is necessary to change behaviour. Various stakeholders also have a vested interest in maintaining the status quo for water resources management systems, policies and practices.

Central Principles

There are four key principles that can help guide the development of a system of water charging.

- i. The environmental principle, which states that the environment is a legitimate user of water in its own right and requires sufficient water to support critical ecosystem functions.
- ii. The economic principle, which states that revenues generated by water use charges should be reinvested back into water resources management.
- iii. The social principle, which states that water use charges must avoid intolerable social or economic inequities.
- iv. The governance principle, which states that water use charges must be embedded within a strong legislative and regulatory regime.

These principles, by and large, enjoyed a measure of consensus and common understanding among the experts we consulted.

Key Questions

When considering a comprehensive water charging system, a number of questions immediately arise. Decision-makers will need to identify the primary problem that water use charges are expected to address, design a charging regime (e.g., what “type” of water is to have a charge, how will charges be determined, how will charges change, how will differential charges be established if required), and determine how the system will be administered (e.g., billing and payment, enforcement). While these are all difficult and complex questions, the better understanding a decision-maker has, the more likely it is that a water charging system will be successful.

Initial Steps to Charging for Water Use

If governments decided to establish a system of water charging they need not design a perfect and complete system to get the ball rolling. First, governments can make the decision to get started. Second, setting a modest charge and using revenues for improving water management can follow this. Third, small local trial projects can be launched to test the waters. Finally, a long term strategy must be developed.

Additional Research

There are a variety of areas where research is needed, including further research on the water resource itself (e.g., surface and groundwater inventories, better understanding the value of water), economic impacts of charges, empirical case studies (e.g., water charging system design and best practices), environmental impacts of water charging, pricing and technology (e.g., cost effective technologies to monitor supplies and meter usage), and improving water literacy.

A Final Word

Water policy in Canada is at a critical juncture, and governments across the country are beginning to respond to emerging water challenges as the water policy community is engaged in dynamic discussions about the future. The importance of water is becoming increasingly recognized; and, developing a proactive plan to address coming stresses and strains on Canada's water supply is essential. As this paper highlights, most water experts agree that water use charges should be integrated into water management policy. The hope of the Canada West Foundation is that this paper provides a launching pad for a more vibrant, engaging and action-oriented policy discussion about water and how Canada's water is managed, priced and consumed.

Introduction: Canada's Water Challenge

Canada's incredible abundance of water has played a large role in the historical development of the nation and water resources remain a critical factor for Canada's social well-being and economic prosperity. Water is essential to virtually all aspects of the economy; from manufacturing, transportation, and natural resource development to power generation, irrigated agriculture, recreation and tourism. Canada's water also supports diverse and globally significant ecosystems. In addition to its economic and environmental importance, Canadians are passionate about the social and cultural significance of water.

Many Canadians, however, are apprehensive about the current and future state of the country's water supply. Canada, like many other nations, is facing major challenges related to the management of water resources. Population growth, continued urbanization, expansion of irrigated agriculture, natural resource development and climate change are pressing upon water resources at home and abroad. In response to these various challenges, attention is increasingly focused on the potential of various financial incentives and market-based mechanisms—including water charges—to improve water resources management policies and practices.

“I know what people say, water's a lot like air. Do you charge for air? ‘Course not; you shouldn't charge for water,’ ‘Well, OK, watch what happens. You won't have any water.”

T. BOONE PICKENS

US billionaire and water entrepreneur.

“You see what happens when demand is growing. The market reacts and people start to use oil in a more efficient way....One thing that does not move at all is the price of water.”

PETER BRABECK

Chairman of Nestle, the world's largest food group.

Charging for Water Use: An Overview

The Project

In late 2010, the Canada West Foundation drafted a discussion paper on charging for water use in Canada. This paper outlined the rationale for and complexities of charging. In early 2011, the discussion paper was sent to a group of 42 water policy experts from Australia, Canada, and the US. Experts were asked to review the paper and provide their comments, but were not asked for their endorsement. The quotes used to animate this paper were all drawn from the 42 participant’s written comments.

This document seeks to describe where there was general consensus amongst the expert panel and provide a solid “workbook” that outlines the questions policymakers must answer in order to build a comprehensive water charging system. The depth and breadth of the questions posed demonstrate just how complicated this topic is—and how much work there still is to be done.

Key Definitions

It is important to make a clear distinction between the terms “pricing” and “charging” for water. A “price” for any good, service or resource can only be arrived at through the interaction of supply and demand in a properly functioning and competitive market. This interaction establishes a market price that reflects the economic value of the good or service in all of its competing uses. When it comes to the concept of water pricing, often what is being referred to is a financial charge (an administered or regulated price) rather than a market price. In the absence of a market, such charges will imperfectly reflect economic value. In short, market prices are economically determined while any other price is politically determined. To avoid confusion, we use the term “charge” to reflect any “price” not determined by market force.

Equally important is what is meant by charging for “water use.” A water use charge is a financial mechanism that attaches a “charge” on all water used or withdrawn from a water source. The concept of water use charging goes beyond the familiar practice of Canadian municipal water utilities and other water agencies (e.g., irrigation districts) where water charges are typically employed to recover the costs of operating and maintaining water and wastewater infrastructure. The water itself is essentially free. The broader concept of water use charges an additional amount for the *use* of water itself (which can include diversions, consumption, effluent discharge, storage and instream uses).

THE QUOTES IN THE MARGIN OF THIS REPORT REFLECT THE WRITTEN COMMENTS OF THE PANEL OF EXPERTS (SEE APPENDIX C)

“This is a dialogue that Canada needs. Water pricing is a strategic lever to open up a lot of important water policy issues that have not been dealt with in this country for decades.”

Traditional Water Management and Allocation

“Many countries, including Canada and the US, manage to muddle through using a combination of neglect, reactive policies, limited pricing, and traditional command and control regulation. The result is misallocated resources, lost opportunities, excess costs, and heavy burdens shifted to future generations.”

“Water scarcity is really about policy. The slowness of institutional adjustments to water scarcity has made the global water crisis a crisis of governance more than a crisis of absolute water availability. Hence, we are confronted not just here but all around the world with the emerging notion of water governance scarcity.”

Three different approaches can be taken to manage and allocate scarce resources. The first approach is “command and control.” Here, governments use legislation and regulation to direct who, when, where, why and how certain goods, services, and resources are to be used. Traditionally, this is how water has been largely managed. Governments create a legal framework (e.g., establishing laws and regulations, issuing water allocations, rights, or licenses) that stipulate the various conditions under which water is to be used. This approach rations scarce resources by providing some of the resource to all while limiting the amount each individual can use.

The second approach employs a competitive market to allocate resources and manage scarcity. Here, the laws of supply and demand intersect to establish a “market price” that rations scarce resources based not on a political decision to legislate and regulate but on the differing capacity of individuals to pay the “market price.” Those with less ability to pay will purchase less and those with more ability to pay will purchase more.

The third approach is a hybrid. Here, a functioning market operates under government legislation and regulation that is intended to direct the market toward achieving specific goals, objectives and outcomes. The current discussion over financial incentives and market-based mechanisms in water resources management is all about supplementing the traditional command and control approach—carried out through government legislation and regulation—with various financial measures to accomplish specific water objectives.

Why Charge for Using Water?

“Pricing has to be an important ingredient in managing water supplies, both quality and quantity. Why? Because money is the common currency for all physical things we value.”

“The myth of limitless abundance is the greatest of all threats to water security because it makes the populace complacent about how much water they have and how it is managed on their behalf. It allows wasteful habits to become cultural traditions and then inalienable rights for which citizens will often fight bitterly against all common sense to maintain.”

Water charges currently do exist in Canada (e.g., charges levied by irrigation districts and municipal water providers) and are generally characterized by users simply paying for the right to use water through a license fee or monthly utility bill that reflects water treatment and delivery costs. However, charges are often not significant enough to effectively communicate the value of water, and in many cases, the amount charged is unreflective of the costs associated with water use, such as treatment, delivery, social and environmental costs (Renzetti 2009). In addition, the water resource itself is not subjected to a charge, and in that sense, is essentially “free.” Many of the experts contended that the value and importance of water cannot be recognized or understood when there are limited financial consequences associated with its use. It is here where the idea of injecting financial incentives and market-based mechanisms into current water resources management comes into play.

The majority of the water policy experts consulted by Canada West Foundation felt that water use charges should play a role in water resources management in Canada. But why should decision-makers consider revising the structure of water charges? On consultation with the expert panel, there was general consensus that charging for water can:

- help limit or moderate water demand;
- increase the supply of water available;
- be flexible and promote choice;
- lever a multitude of important goals and objectives, such as stimulating conservation, incenting pollution reduction, ensuring future cost savings for governments and helping to guarantee sustainability for future generations;
- help fund a more scientific and rational system of water resources management;
- allow the cost of human impacts on water resources to be better accounted for; and
- be accepted by Canadians, who are already accustomed to receiving water bills.

Many of the experts pointed out that changing the way we charge for water makes sense, if only because Canadians typically pay a fraction of the cost of water treatment and infrastructure. These individuals held the view that “cheap water to households is an economic subsidy, not a public necessity.” This concept ties into the debate on who should be carrying the cost burden for water use and treatment—taxpayers or individual users? Other experts felt that water charges have the ability to incent conservation, help deal with issues of scarcity, prevent waste, end the myth of water abundance, encourage Canadians to change their water use behaviours, and learn to value water more highly.

“Pricing of water is an effective instrument to incent conservation and protection of water resources on a broad geographic scale. As we have seen from rising fuel prices, there is a direct correlation between price and consumption. Developing a cost for use, consumption, and pollutant discharge will incent users to find efficiencies and minimize pollutant discharges. There are few other instruments available that will have such an immediate and profound effect on Canadians’ use of this finite resource as pricing.”

Many experts said that there are real environmental, economic and social limits to the way water is currently used and managed, and finding improved ways to manage water supplies and water demand is an essential task—particularly in a world characterized by increasing industrial pressures (e.g., from energy development) and strained public purses which limit spending on water infrastructure. Charging for water use is one way to accomplish this task.

Although a clear majority of the experts agreed that water use charges have a role to play in management, many also offered important qualifiers. For example, it was frequently mentioned that charging for water is not a panacea for all of Canada’s water woes, rather, it is one tool of many. Charging for water also works best within a strong regulatory environment and alongside other initiatives, such as awareness campaigns and stricter legislation. In addition, specific water goals and objectives must be identified in order for a charging system to be successful.

Before proceeding, it should be noted that although the majority of experts consulted were in favour of water use charges, some were not supportive of changing the status quo. Some experts simply felt that no problem exists and disagreed that “providing free water threatens the sustainability of the resource.” Other experts acknowledged that water challenges do exist, but were skeptical that charging for use could solve anything, citing complex and costly administration, expanded government involvement, a high possibility of failure, concern for social and economic equity, and a belief that charges would take money away from users that could instead be used for water savings technologies.

The Challenges of Charging for Water Use

“I think what is really needed is to move beyond broad conceptual treatment and get down to the difficult job of data collection, calculation of prices, and modeling their impacts.”

“The only way we will be able to arrive at an equitable pricing system is to first decide that all water users and returns need to be metered. This is likely the most formidable challenge because this means all users of ground, surface water, and domestic water will have to account for water use. Without it, we cannot properly determine present and future demands, effectiveness of conservation methods, water footprints, and efficiencies.”

The use of financial incentives and market-based mechanisms for water management may be one of the most contentious issues in the water policy world. Although there is a general consensus among experts that these tools can improve water resources management, there is still reluctance on the part of policymakers to seriously consider such reforms, and for good reason.

The debate over charging for water use, for example, is not just about increasing monthly water bills by a few dollars. While this is politically problematic enough, the debate is much bigger than that. It is a debate about the value of water and societal attitudes toward its use. It is a debate about both social and economic equity, ensuring that those who are less fortunate are taken care of, and that Canadian business stays competitive. It is a debate about governance and jurisdictional challenges. It is a debate about the state and sustainability of Canada’s water infrastructure. Charging for water use is a multi-dimensional issue, and once the surface is scratched it is easy to become embroiled in a myriad of other questions and concerns.

There are numerous complexities associated with charging for using water. Some of these complexities lie in the wide array of choices open to policymakers. Others accrue from a lack of understanding about how those choices might impact water and various water users. In addition, it can be difficult to arrive at the “right” financial charge, which is necessary to change behaviour. Arriving at the right price point requires massive amounts of information, data collection and modeling, as well as metering, measuring and monitoring of all water users. Various stakeholders also have a vested interest in maintaining the status quo for water resources management systems, policies and practices. But regardless of its complexity, the debate on water use charges is certainly needed. As demand increases for food, energy and water, policymakers across Canada and the globe are grappling with finding new and improved ways of managing water resources. Charging for water use may be one of those ways.

The responses gathered from the expert panel on the challenges of establishing a water charging system tended to flow in two directions. The first group generally sidestepped the challenges of implementing such reforms while maintaining strong commitment to the idea. The second group was a mixture of proponents and opponents who acknowledged the difficulties that can arise from establishing such a system. Chief among the difficulties cited was the extensive data needed to accomplish an effective charge, the need to monitor, meter and measure all water users in all sectors, and the need to better understand the potential impacts on various sectors and the broader Canadian economy. In the words of one expert, “the concept of universal water pricing is often grossly over-simplified.” Contrasting that sentiment was another expert who stated, “If the problem is just over-use, then any price will do.”

Central Principles

“It is now widely held that the fair pricing of water need not conflict with the notion of water as a human right. Adequate supplies for the most basic human needs can be priced very cheaply or even provided free.”

“Water pricing can be a useful tool. But so too can other measures that subject water use decisions to economic incentives, such as active markets for water and water rights... To work effectively, water pricing would have to be accompanied by a number of other legislative, regulatory, or management changes. If implemented poorly, water pricing can make the situation worse.”

As policymakers continue to address water challenges, it is important that they follow an approach based on widely accepted principles. The following principles enjoyed a measure of consensus and common understanding among the 42 experts we consulted and can help guide the development of a water charging system.

- I. **Environmental Principle:** *The environment is a legitimate user of water in its own right and requires sufficient water to support critical ecosystem functions.* It is essential to identify and allocate water ecosystem needs—that is, the minimum amount of water an ecosystem requires for ecological integrity to be maintained. This task requires extensive data collection and continuous monitoring efforts to ensure that human activities are carried out within environmental limits. Ensuring that water resources remain healthy will ultimately benefit human users for generations to come.
- II. **Economic Principle:** *Revenues generated by water use charges should be reinvested back into water resources management.* A critical component of the case for a water charging system is that water charge revenues should be directed back into water management initiatives. Any charging initiative that is seen as a way to direct funds into the general coffers of provincial governments will find essentially no support within the policy community or with the public at large. Revenues generated from the usage charges must be directed back to the original “water problem,” whether to repair failing water infrastructure, or to improve research and monitoring capacity. At a minimum, water use charges must cover the costs of water infrastructure operations and maintenance.
- III. **Social Principle:** *Water use charges must avoid intolerable social or economic inequities.* Water is a multi-dimensional resource with many different uses in society. Everyone should have sufficient water to care for their basic needs regardless of their ability to pay—particularly those who are most at risk in rural and remote areas. In some cases there may be legitimate social drivers to address economic inequities. Some large-scale water users, such as irrigators, may not be able to afford the same charge for water as other users, such as the energy or manufacturing industries. Addressing these types of disparities may be necessary to maintain social cohesion in communities. As such, various differential charging schemes may need to be developed.
- IV. **Governance Principle:** *Water use charges must be embedded within a strong legislative and regulatory regime.* Since water is a natural resource, any potential system of charges likely rests within the provincial realm, although there is clearly a role for the federal and municipal governments. It is the responsibility of governments to ensure that appropriate legislation and regulations are in place to support a system of water use charges. This holistic system should be based on a strong scientific foundation that is focused on monitoring, metering and measuring.

Key Questions

When considering a system of water charges, a number of questions immediately arise. Decision-makers will need to identify the primary problem that water use charges are expected to address, decide how to design a water charge regime, and determine how revenues will be used. The following list outlines a series of important questions, which outline the complexities of developing a water charging system.

The better the understanding decision-makers have of each question, the more likely it is that a water charging system will be successful. The full list of questions with examples of answers can be found in Appendix A.

1) Goals and Objectives

- What is the primary problem that water use charges are expected to resolve?
- By which means would the primary problem be addressed?

2) The “Charging” System

- What type of water will be subjected to a financial charge?
- On what basis will water use charges be determined?
- What is the sectoral scope?
- What is the spatial scope?
- How will the charges be viewed?
- What costs are to be included in the charge?
- How will water use charges be structured?
- What additional features might be built into a system of water use charges?
- Should a system of credits be devised?
- Will the water use charges change?
- What stakeholder engagement strategy will be used?

3) Managing Issues of Equity

- How can social equity be assured?
- Should differential charging be used?
- Should some water be exempt?

4) Use of the Revenues

- How should the revenues be used?
- Should revenues be shared?

5) Governance

- What “authority” will administer the charges?
- What are the tasks and the powers of the authority?
- What resources are required for the authority?

6) Administration

- How will billing and payment be handled?
- What is the process for appeals, objections and disputes?
- How will enforcement be handled?

7) Implementation

- When is the right time to implement?
- What legislative or institutional changes might be required?
- What steps need to be taken to ensure openness, visibility, and transparency?

8) Evaluation

- How will the responsiveness of water use charges be measured?

The expert panel stressed that clearly defining the goals and objectives of a water charging regime is the key to success. One expert said, “Pricing and its use depends entirely on the nature of the challenge.” These objectives must be clearly defined from the start of the process, otherwise water use charging “can create new problems if not properly designed.”

However, most expert panellists acknowledged that defining a water use charge is difficult. Many agreed that charges should vary by “type” of water (e.g., fresh, brackish, gray) and that volumetric rates should replace flat rates that are currently in place. Some experts clearly flagged the difficulties associated with water valuation and the immense information needs that are required, not to mention infrastructure requirements such as meters for each water user. Most felt that water use charges should reflect both quality and quantity considerations. Some experts did caution that putting a charge on water pollution or discharge could have the potential to allow wealthy industries to pay for the right to pollute. This underscores the need once more for effective legislation and regulation to exist alongside water and wastewater charges. Other experts offered even more options to consider, such as multiple market levels, wholesale and retail charges, spot prices and futures pricing.

Some experts were concerned about the social equity impacts of water use charges, particularly on those with low incomes and certain economic sectors, such as irrigated agriculture. Experts representing the latter stressed that irrigators are price takers on world markets, and as such, cannot easily pass the water use charge on to the final consumer. Although certain crops may require less water and thus be more desirable, shifting to these crops can be challenging depending on factors such as soil and climate. Suggested ways around these concerns included exempting a base amount of water from a water use charge and instituting differential water use charges for different sectors.

Most experts reacted favourably to the list of key questions outlined above. The list was seen to be generally complete, although it is possible that additional questions will arise in the future. A few felt the questions, or the way they were structured, were insufficient. For these experts, the list could have been improved upon by ranking the questions in order of importance, and noting any research that provides answers to the questions, as well as offering more fully developed ideas and options. The different options for designing a system of water charges and the range of governance and administrative considerations appeared to overwhelm some experts, who felt that the whole matter is just too complicated and complex. Such a system, it was feared, would expand the size of government and entail significant costs.

Water use charging does depart from traditional water resources management practices in Canada. Such a departure can be difficult to envision and implement in one fell swoop. The stakes are also high—water is an essential input across all sectors of the economy and no one has a firm understanding of the macro-economic implications, the impact on Canada's economic competitiveness, or the inter-sectoral effects of charging for water use.

In addition, a number of precursors are required before a water charging system can take hold, such as detailed information on water resources, water users, abstraction rates, return flows, and wastewater and effluent discharges. Effective charges for water use is dependent on a robust commitment to monitoring water supplies, metering usage and measuring returns. Yet, a large number of Canadian residences remain unmetered, little is publicly known about self-supplied water use by industrial and commercial users, and even some large consumers such as irrigators do not currently measure the volumes of water used.

Setting an appropriate charge and finding the right “price-point” can be difficult and expensive. Full-cost accounting for the operation and maintenance of water and wastewater infrastructure—source supply, headworks, collection, treatment, distribution, wastewater collection, and sewage treatment and disposal—can also be hard to determine, never mind the long-run costs of capital rehabilitation and replacement. In particular, ensuring that social and environmental charges are reflected is complex and can vary by sector, location, and time. Stakeholders also need to be invited to help build the system, and there is a need for significantly improving the water literacy of the public.

There was a consensus among the water experts that water use charging is a hugely complex issue, one that raises questions that are very difficult to address. However, improved water management is so important for Canada that we cannot and we must not let the complexity of the challenge paralyze us. What then, are the next steps?

Initial Steps to Charging for Water Use

“I would suggest that a lack of ‘complete understanding’ should not be an impediment to developing a reasonable price for water. I agree that small steps should be taken to educate stakeholders and fund future research, but we should not hesitate based on limited information to move to more realistic pricing for water.”

“Starting small with a pilot to work out the difficulties would be an excellent approach. It will be impossible to identify all of the unintended market and social consequences of any pricing scheme in advance, so a go slow approach is a careful way to identify and address these problems.”

If water use charges have been identified by governments as a tool to be used for water management, there are some incremental steps that can be made. As noted by Dr. Peter Pearse, professor emeritus at the University of British Columbia and a specialist in natural resources management and policy, even a “modest charge” gets policy working in the right direction. According to Pearse, finding the “perfect price” is not required to send a message to users about the value of water, and one of the biggest initial hurdles is simply securing broad-based agreement on charging for water in principle, and then arriving at a modest rate schedule—at least to start (Pearse 2002). The following section outlines the four incremental steps that can be taken toward a water charging system.

Make the Decision to Get Started

The majority of experts consulted by the Canada West Foundation agreed that water use should be “priced” as a matter of principle and the charges should play a role in water resources management. An incremental approach to water use charges was strongly reinforced by the expert panel. Many experts urged policymakers to start now and cautioned against letting the desire for a “perfect” system or financial charge stand in the way of reforms. Other experts suggested that pilot projects should get underway. Although this issue is timely, most argued it is essential to continue to expand knowledge of water resources and continue research on water valuation.

Experts had differing opinions on the best way to “start now.” Some felt that the first step should be strong environmental regulation that determines instream flow needs and enshrines ecosystem needs in legislation. Other experts felt that the first step should be to increase awareness campaigns to help the public understand their water use patterns and habits. Another suggested first step was to carry out a detailed scientific assessment of the quantity and quality of water available in all watersheds. Some experts suggested that modeling or simulation should be conducted that would determine the effect of various charge scenarios.

Set a Modest Charge and Use Revenues for Improving Water Management

“The government needs greater institutional capacity to measure and manage water use more comprehensively. Water users who benefit economically from the water must shoulder more of these costs via pricing.”

“There is little evidence that nominal or ‘placebo’ pricing is sufficient to trigger a fundamental shift in personal, corporate, or municipal values towards better decision making. While it is easy to celebrate steps that meet with nominal resistance and broad acceptance, we may not have the luxury in some jurisdictions.”

It may be advisable to set a rate schedule that is modest—at a level where the charge should cause little to no objection, disruption, or harm. This follows the approach used by the province of Ontario in 2007, when a new volumetric fee on water withdrawals was imposed on large industrial and commercial users in selected industries. While the fee has been criticized for being too low to create any incentive—almost three cubic meters of water can be purchased for 1¢—some feel it is a start in the right direction. Recently, the province of Quebec announced it will begin pricing water as well (*see Discussion Box 1*). While many of the expert panellists agreed with this basic approach and were sympathetic with the suggestions of Dr. Peter Pearse, not everyone was on board. Some experts noted that such “placebo” pricing would do little to change behaviour and governments would still be stuck with the difficult task of increasing charges to a more reasonable level if required. Instead, charges should be set at the margin where there is the ability to influence change. These experts predicted that this would require a two or even three-fold increase in current charges, a solution that would be deemed socially and politically unacceptable.

Since building a comprehensive water charging system would take time, effort and money, a good portion of generated revenue should be reserved for improving water resources management by making critical investments in monitoring, metering and measuring, new infrastructure, and ongoing research and evaluation on the effects and impacts of charging. In Australia, for example, billions have been invested in establishing scientific monitoring and metering of water, in addition to programs for determining sustainable yield² and water management. Employing the revenue for water management purposes has a number of logical links. For example, those who are using the resource are required to pay, and the funds generated are employed to offset the environmental consequences of that use and make necessary investments for improved water resources management. Experts were in strong agreement that any revenues be re-invested in water resources management. Those experts that did not support water use charges argued that monies were better left in the hands of water users to pursue more efficient water technology on their own.

² Sustainable yields projects are to undertake scientific assessments providing robust estimates of current and future water yield in several regions of Australia. Source: Australian Government, Department of sustainability, water, environment, population and communities.

DISCUSSION BOX I: FIRST STEPS FOR WATER USE CHARGES IN ONTARIO, QUEBEC AND THE EU

Ontario: In August 2007, the Ontario provincial government filed a new regulation under the Ontario Water Resources Act that established a regulatory charge for the withdrawal of water by certain industrial and commercial users taking more than 50 cubic metres of water per day. The charge came into effect in early 2009 and was set at \$3.71 for each 1,000 cubic metres of gross water abstracted. The charge was criticized by the Environmental Commissioner of Ontario (ECO) for being too low, and for applying only to a limited number of large water users. The ECO felt that the charge would do little to promote conservation, protection or improved management of Ontario's water resources. However, the ECO also admitted that the new water charge seems to be the first phase of a multi-phase approach. In future phases, the amount of the charge is likely to increase, and it may apply to other water users.

Quebec: In December 2010, the Quebec provincial government followed Ontario's lead and announced that it would begin charging industrial and commercial water users in 2011. The province announced that two rates would be established. The first rate would apply to manufacturers of bottled water, juice and other beverages, as well as non-metallic minerals such as pesticides, fertilizers and other inorganic chemicals. The rate was set at \$70 per 1,000 cubic metres of water taken. A second rate of \$2.50 per 1,000 cubic metres is meant to apply to other targeted economic sectors. Revenue collected from both fees is to be directed into Quebec's "Green Fund", which supports the environmental initiatives in the province. According to the provincial Environment Ministry, the new charge is designed to send a message that the province's water resources must be used rationally and responsibly.

EU: The European Union Water Framework Directive (WFD) is a guiding framework that applies to all EU member states and protects all water sources in Europe. The framework came into effect in 2000. The WFD amalgamates decades worth of water policy in the EU under one umbrella and is the culmination of various consultations with representatives of member states, regional and local authorities, enforcement agencies, water providers, industry, agriculture, consumers and environmentalists. A core concept of the WFD is the use of market mechanisms for water management. A long term plan has been developed for the gradual phase-in of full-cost water charges for all water users, and a timetable that sets forth progressive goals from the present until 2027 has been developed.

Source: Environmental Commissioner of Ontario 2008; European Commission 2010; Van Praet 2010.

“We cannot allow perfection to impede progress. The piloting of a province-wide base price with a regional rider based on economic and environmental drivers would validate the viability of the water pricing model, and should be developed as soon as possible.”

Start Small, Local Trial Projects

Many experts expressed a preference to start charging for water sooner rather than later, by initiating small-scale local trial projects. Western Canada may offer particularly useful sites for trial or pilot projects, as there are a variety of local water challenges across the region. Water scarcity is posing a problem in the interior of British Columbia and southern Alberta, improved water quantity management (flood and drought) is needed in Saskatchewan and Manitoba, and the eutrophication of Lake Winnipeg continues.

The unique mix of water challenges could all be addressed in one way or another by improving or implementing water use charges. Launching pilot projects to address different water problems would be a telling experiment and would provide a fair amount of data that could outline the conditions under which water use charges work best.

Develop a Long Term Strategy

“We do need to make long term plans for water supply and watershed protection, and getting stable funding in place is a first step.”

As research is conducted, expertise and experience accumulated, investments in equipment and infrastructure are made, and evaluations are completed, policymakers can begin to build out a longer-term strategy and a more comprehensive system of water charges, if deemed necessary.

Decisions over such matters as developing offsets for those with low incomes, a system of credits, additional pricing features, differential charging schedules and managing changes in the water use charge can all be made as the system becomes more detailed, comprehensive, and oriented toward achieving specific water management objectives. As the familiar phrase puts it, “A journey of a thousand miles starts with the first step.” A modest start with little impact is that first step, but the goal remains to finish the journey. In many ways, this mirrors the experience of water use charging in the EU, where pricing practices today were 35 years in the making (*see Discussion Box 1*).

Additional Research

“Water is inherently personal, emotional, and political—drivers that may not be well-suited for pricing mechanisms to influence. As such, at the end of the day, I think an analysis of the role of pricing needs to be considered in light of the other options that may be available to achieve the same outcomes.”

In addition to the various design questions posed above, there are a number of gaps where research is needed. In some cases, these areas of additional research are baseline requirements for a system of water use charges. In particular, most experts consulted stressed that measuring and monitoring is essential—in order to effectively charge for water, we must know how much water we have and how much is being used.

The Water Resource

- Building an inventory of surface and groundwater supplies.
- Assessing potential changes through increased water usage and climate variability.
- Securing data on water usage, consumption, and returns as opposed to licensed allocations.
- Generating data on the use, and intensity of use, of various water sources.
- Understanding the connectivity between ground and surface waters.
- Exploring the impact of charges on the connectivity between ground and surface waters.
- Better understanding the value of water.

Economic Impacts

- Impact of charges on regional, provincial, and national economic competitiveness.
- Impact of charges on various economic sectors, and economic equity issues between sectors.
- Research on how to advance concepts of full cost accounting and full cost recovery of water use.
- Research on recovering and internalizing social and environmental costs of water use.

Empirical Case Studies

- Water charging system design and best practices in other jurisdictions with a sectoral focus.
- Developing case studies and assessing their applicability to Canadian circumstances.
- Designing and implementing water charging pilot projects.

Environmental Impacts

- Impact of water charging and its value as a conservation tool and stimulus for behavioural change.
- Devising appropriate price points to stimulate conservation and change water use practices.

Pricing and Technology

- Technological options for water infrastructure and the potential for commercialization.
- Cost effective technologies to monitor supplies, meter usage, and measure return flows.

Education

- Understanding political and public barriers to new and emerging water technologies.

A Final Word

Water policy in Canada is at a critical juncture, and governments across the country are beginning to respond to emerging water challenges as the water policy community is engaged in dynamic discussions about the future. The economic, cultural, social and environmental importance of water is becoming increasingly recognized. Yet, talking about and recognizing water's immense importance is not enough. Developing a proactive plan to address upcoming stresses and strains on Canada's water supply is essential.

As this paper highlights, most water experts we consulted agree that water use charges should be integrated into water management policy. Work must continue on determining the role that water use charging has to play in water management, research must be conducted on the potential impacts of changing how we charge for water use, and tangible, clear and manageable action steps must be identified. The hope of the Canada West Foundation is that this paper has provided a launching pad for a more vibrant, engaging and action-oriented policy discussion about water and how it is managed, priced, and consumed.

Appendix A: Key Questions in Detail

1) GOALS AND OBJECTIVES

a) What is the primary problem that water use charges are expected to resolve?

Challenges can vary across major basins, sub-basins and local watersheds. Charging systems cannot always achieve a multitude of objectives simultaneously.

EXAMPLES:

Insufficient quantity	Intolerable water variability or unpredictability
Compromised quality	Inadequate water infrastructure
Water pollution	Underfunded water utilities or agencies

b) By which means would the primary problem be addressed?

There are a variety of ways to address a water challenge.

EXAMPLES:

Water conservation	Encouraging specific water uses
Water rationing	Efficient irrigation
Water allocation	Increasing water reuse and recycling
Pollution prevention	Improving water literacy
Cost recovery	Stimulating higher valued water usage
Source protection	Demand management

2) THE “CHARGING” SYSTEM

a) What type of water will be subjected to a financial charge?

There are many “types” of water differentiated by quality, source, and intended use.

EXAMPLES:

Water abstractions	Water effluent and discharge
Water diversions	Only high quality freshwater
Water consumption	Water storage
Fresh surface water	Offstream use only
Fresh groundwater	Offstream and instream use

b) On what basis will water use charges be determined?

Government efforts to charge for water use can take a number of different forms.

EXAMPLES:

Administered charging	Water taxes
Regulated charging	Market pricing

c) What is the sectoral scope?

Water use charges can apply to all water users, or only a select few users.

EXAMPLES:

Applies to all water users	Applies to large water users only
Applies only to certain sectors	Start in one sector and later expand to all sectors

d) What is the spatial scope?

Charges for water use can be applied across an entire jurisdiction or applied in certain regions and watersheds only. Charging can also be implemented gradually or quickly.

EXAMPLES:

Across entire province	Start charging in one region with intent to expand
Restricted to certain regions only	Start with small pilot projects only

e) How will the charges be viewed?

Water use charges can be viewed in different ways—some ways may be seen as more palatable than others.

EXAMPLES:

A water tax	A direct user fee
A water royalty	An indirect user fee

f) What costs are to be included in the charge?

There are a variety of costs associated with water use, some of which are more easily quantified than others.

EXAMPLES:

Environmental costs	Operations and maintenance of infrastructure
Average costs	Future capital replacement costs
Marginal costs	Social costs

g) How will water use charges be structured?

The cost and value of water varies across different sectors. Charges for water use should be structured to reflect this diversity.

EXAMPLES:

Municipal

Flat rate
Constant volumetric
Increasing block volumetric
Declining block volumetric
Two-part tariffs
Average cost pricing
Marginal cost pricing
Sewerage surcharges

Agriculture

Charges based on irrigated acreage
Charges based on land value
Charges based on crop type
Charges based on application methods
Charges based on volumes used
Charges based on land quality considerations

Self-Supplied Industrial or Commercial

Flat rate
Constant volumetric
Increasing block volumetric
Declining block volumetric
Discharges and effluents

h) What additional features might be built into a system of water use charges?

There are a range of other charging practices that could be employed.

EXAMPLES:

Seasonal charges	Lower charges for installation of water-efficient technology
Peak-period charging	Lower charges for high quality discharge or return flows
Charges based on type of usage	Lower charges for well-timed diversions, intake, and discharge

i) Should a system of credits be devised?

A credit system can be devised in conjunction with water use charges to provide extra incentives. Some kinds of credits may help lever additional policy goals.

EXAMPLES:

Credit for high quality return flows	Credit for water purchased but unused
Credit for using new technology	Credit for conserved water

.....
 j) Will the water use charges change?

Charges can be static over time, or they can change to accommodate new and emerging circumstances.

.....
 EXAMPLES:

Supply and demand only	Public hearings on rate changes
Supply, demand, and other	Applications to a price regulator

.....

.....
 k) What stakeholder engagement strategy will be used?

Policy development, implementation and management should be done in consultation with key water stakeholders.

.....
 EXAMPLES:

Stakeholder forums with various levels of government
 Communications, education and outreach activities
 Support and service information for water users

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.....
 3) MANAGING ISSUES OF EQUITY

.....
 a) How can social equity be assured?

Water use charges brings up concerns surrounding social equity. However, there are options that can be used to offset negative effects on those with low or moderate incomes, or large-scale water users (e.g. irrigators) who cannot afford the same charge as other users (e.g. energy or manufacturing industries).

.....
 EXAMPLES:

Credits and rebates	Base amount of water per month is exempted
Subsidies and life-line rates	Base amount subjected to a lower charge

.....

.....
 b) Should differential charging be used?

Should the rate schedule be uniform across all regions and sectors, or should there be differential rate schedules? How will differentials be calculated? On what basis will they be defended?

.....
 EXAMPLES:

Differentials by region	Differentials by municipal class
Differentials by sector	Differentials by water type or source
Differentials by quality	

.....

.....

c) Should some water be exempt?

Exemptions from charges takes differentials further. There may be a case for exempting some water in special circumstances.

.....

EXAMPLES:

Exempt a base amount per house	Exempt a base amount for all uses and charge only for the excess
Exempt a base amount per person	Exempt existing users so investments are not put at risk

.....

4) USE OF THE REVENUES

.....

a) How should the revenues be used?

Charging for water use will create a new stream of revenue, and this revenue can be handled in a variety of ways.

.....

EXAMPLES:

Improve existing infrastructure	Monitoring, metering, and measuring of all users in all sectors
Water efficient technologies	Rebate revenues to users, but keep incentives intact
New systems like water recycling	Funding for water strategies
General government revenues	Education and awareness campaigns and programs

.....

b) Should revenues be shared?

It must be decided whether revenue should be shared between governments or if revenues are concentrated with one overseeing body.

.....

EXAMPLES:

Revenues to the province only	Shared with other agencies like irrigation districts
Shared with local governments	Shared with local water groups in the form of grants

.....

5) GOVERNANCE

a) What “authority” will administer the charges?

An authority must be in place to administer the system.

EXAMPLES:

Existing unit in a department	Decentralized authority operating at local level
New unit in a department	Representation of water users
Entirely new department	Representation of water councils and advisory groups
New provincial water agency	

b) What are the tasks and powers of the authority?

The extent of the powers of the authority must be determined and issues such as the possibility of outsourcing services must be addressed.

EXAMPLES:

Setting water charges	Billing and payment
Administration of the system	Handling complaints and appeals
Monitoring, metering, measuring	Hearing and settling disputes
Research and analysis	Investigations
Communications	Enforcement

c) What resources are required for the authority?

Some authorities will require a vast array of resources (new equipment, infrastructure, technical and financial). Other authorities may already be well-equipped.

EXAMPLES:

Water inventory information	Monitoring, metering, and measuring infrastructure
Administrative personnel	Databases, management, and information systems
Technical personnel	Computing and information technology
Logistical support personnel	Training and professional development
Legal expertise on licenses	Operating and policy manuals

6) ADMINISTRATION

a) How will billing and payment be handled?

For water use charges to be successful, it is imperative that water use be metered and measured, and that users are billed accordingly.

EXAMPLES:

Payment only for water used	Partial payment up front with a final billing
Payment for all water under license	Regular payments over the year

b) What is the process for appeals, objections, and disputes?

There will likely be complaints and appeals. A process for handling these appeals must be determined.

EXAMPLES:

Who has standing in an appeal	Rules of evidence
Representation by legal counsel	Calling of witnesses
Written appeals or oral hearings	Rules governing arbitration and mediation
Time limits on the process	Final avenues of appeal

c) How will enforcement be handled?

Penalties and regulations must be devised to ensure that water users abide by and adhere to requirements.

EXAMPLES:

Late payment surcharges	Suspension or revoking of water license
Fines and penalties	Lowering water allowed under current license

7) IMPLEMENTATION

a) When is the right time to implement?

Water use charges can be applied all at once, they can be gradually phased-in, or it can be introduced through pilot projects.

EXAMPLES:

Experimental pilot projects	A “phase-in” period
Staged implementation	Voluntary pricing to start

b) What legislative or institutional changes might be required?

The legal and institutional implications of water use charging should be well understood prior to implementation.

EXAMPLES:

New legislation	New regulations to existing legislation
New institutions	Plebiscites or referendums
Order-in-Council	Role of the courts

c) What steps need to be taken to ensure openness, visibility, and transparency?

In order to be successful, a system of water use charges must be seen as legitimate and transparent.

EXAMPLES:

Publishing rate information	Production of an annual report
Public release of water use data	Production of quarterly updates

8) EVALUATION

a) How will the responsiveness of water use to charges be measured?

Metrics must be defined in order to measure the success of pricing policies.

EXAMPLES:

Increased media coverage
 Change in water consumption where meters exist
 Decrease in interprovincial or regional water conflicts

Appendix B: Glossary

Financial incentives: Financial incentives include taxation and subsidies. When governments decide to tax a good, service, or resource, the cost to consumers rises. Thus, taxation can serve to lower demand for whatever is taxed and encourages consumers to seek out substitutes or alternatives. On the other hand, governments can also choose to subsidize a good, service or resource through tax breaks, credits, rebates, grants, or expending tax dollars. Subsidies work in the opposite direction of taxation, resulting in lower costs that encourage higher consumption.

Market-based mechanisms: Market-based mechanisms can include government attempts to establish a price for a good, service or resource with strong public good characteristics. For goods and services provided by the government, the price can be termed an “administered price” and is intended to recover the costs of provision. For public or monopoly goods and services provided by the private sector, governments often choose to establish a regulated price. Regulated prices can be specific or can range between a minimum floor price to a maximum ceiling price. Finally, governments can work to create the necessary conditions for a competitive market (e.g., create scarcity, encourage numerous buyers and sellers, define property rights, establish a trading platform, lower transaction costs) and let transactions between producers and consumers set a “market-price.” All such attempts can be referred to as market-based mechanisms.

Appendix C: Water Experts

The following is a list of the 42 water policy experts from Australia, Canada and the US who engaged in consultation with the Canada West Foundation. Experts were *not* asked to provide an endorsement of the draft discussion paper, or on the policy of using water use charges in water management. Rather, respondents were asked to share their insights and feedback to ensure that our work adequately captured and reflected elements of the current debate within the water policy community. While there are well-regarded water policy experts that we have no doubt missed in our consultation, such exclusion was not intentional.

QUESTIONS ASKED OF THE EXPERT PANEL

Along with giving their reaction to the draft document, members of the expert panel were asked to respond to four specific questions:

- 1) Do you believe that integrating charging [pricing] into water resources management in Canada is needed to address water supply (quality and quantity) challenges?
- 2) If so, do you find the case for water use charging [pricing] and the principles to be comprehensive?
- 3) Do you find the key questions posed in the document to be comprehensive?
- 4) Are the initial steps toward a water charging [pricing] system comprehensive and realistic?

The answers provided to these questions along with related commentary appear throughout the document at the relevant sections where they apply.

LAST NAME	FIRST NAME	POSITION	INSTITUTION OR ORGANIZATION
Adamowicz	W.L. (Vic)	Distinguished University Professor, Department of Rural Economy, Faculty of Agricultural, Life and Environmental Sciences	<i>University of Alberta</i>
Arling	Bill	Manager, Environment, Corporate Health Safety Environment & Social Responsibility	<i>Nexen Inc.</i>
Bankes	Nigel	Professor and Chair of Natural Resources, Faculty of Law	<i>University of Calgary</i>
Bell	Maureen	Executive Director and Lawyer	<i>Water Rights Inc.</i>
Berzins	Bill	President	<i>Fossil Water Corporation</i>
Bjornlund	Henning	Canada Research Chair in Water Policy and Management, Department of Economics & Associate Research Professor	<i>University of Lethbridge & University of South Australia</i>
Boland	John J.	Professor Emeritus, Department of Geography and Environmental Engineering, Whiting School of Engineering	<i>Johns Hopkins University</i>
Boyle	Kevin J.	Department Head and Professor, Department of Agricultural and Applied Economics	<i>Virginia Tech</i>
Brandes	Oliver M.	Associate Director of the POLIS Project and Water Project Lead, POLIS Project on Ecological Governance	<i>University of Victoria</i>
Campbell	Carolyn	Conservation Specialist	<i>Alberta Wilderness Association</i>
Catley-Carlson	Margaret	Global Water Partnership Patron	<i>World Water Council</i>
Conant	Bernadette	Executive Director	<i>Canadian Water Network</i>
Doucet	Joseph A.	Enbridge Professor of Energy Policy, Alberta School of Business	<i>University of Alberta</i>
Dupont	Diane P.	Professor of Economics, Department of Economics	<i>Brock University</i>
Fargher	Will	General Manager, Water Markets and Efficiency Group	<i>National Water Commission, Government of Australia</i>
Furlong	Kathryn	Assistant Professor, Department of Geography	<i>University of Montreal</i>
Gerdes	Brian	VP, Market Development	<i>EPCOR</i>
Good	Allen G.	Professor, Department of Biological Sciences	<i>University of Alberta</i>
Hill	David	Program Director	<i>Alberta Water Research Institute</i>
Horbulyk	Ted	Associate Professor, Department of Economics	<i>University of Calgary</i>
Janmaat	Johannus (John) A.	Associate Professor of Economics	<i>University of British Columbia</i>

LAST NAME	FIRST NAME	POSITION	INSTITUTION OR ORGANIZATION
Kelly	Mike	Management Team	<i>Alberta WaterSMART</i>
Kolk	John	Manager	<i>Kolk Farms Conrich Ltd.</i>
Lamb	Susan	CEO	<i>Meewasin Valley Authority</i>
Mullen	Jeffrey D.	Associate Professor of Agricultural and Applied Economics, College of Agricultural & Environmental Sciences	<i>University of Georgia</i>
Obad	Joe	Associate Director	<i>Water Matters</i>
Pearse	Peter H.	Professor Emeritus, Forest Resource Management Department	<i>University of British Columbia</i>
Pearson	Ron	Board Member	<i>Trout Unlimited Canada</i>
Percy	David R.	Borden Ladner Gervais Chair in Energy Law and Policy, Faculty of Law	<i>University of Alberta</i>
Quail	Rick	Municipal Manager	<i>Town of Okotoks</i>
Renzetti	Steven	Professor, Department of Economics	<i>Brock Environmental Sustainability Research Unit, Brock University</i>
Rogers	Peter P.	Gordon McKay Professor of Environmental Engineering and Professor of City Planning, Division of Engineering and Applied Sciences	<i>Harvard University</i>
Sandford	Bob	Chair	<i>Canadian Partnership Initiative, United Nations Water for Life Decade</i>
Schreir	Hans	Professor, Institute for Resources, Environment and Sustainability	<i>University of British Columbia</i>
Stewart	Judy	Director, Barrister & Solicitor	<i>Alberta Lake Management Society</i>
Swain	Harry	President (Formerly with the Centre for Global Studies and the Pacific Climate Impacts Consortium, University of Victoria)	<i>Trimbelle Investments Ltd.</i>
Torr	Stuart	Managing Director	<i>Integrated Sustainability Consultants Ltd.</i>
Venema	Henry David (Hank)	Director, Water Innovation Centre and Sustainable Natural Resources Management Program	<i>International Institute for Sustainable Development</i>
Weber	Marian	Adjunct Professor, Rural Economy Department of Resource Economics & Environmental Sociology	<i>University of Alberta</i>
Wheater	Howard	Canada Excellence Research Chair in Water Security	<i>University of Saskatchewan</i>
Zehnder	Alexander J.B.	Scientific Director	<i>Alberta Water Research Institute</i>

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