



Canada as the Water Solutions Country:

Defining the Opportunities

This is the second in a series of reports prepared for the Blue Economy Initiative



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Introductory Letter

On behalf of the founding partners of the Blue Economy Initiative, I would like to thank those who participated in our panel event held on March 4, 2013 in Toronto. The goal of this convening session was to inspire dialogue among business, government and other leaders around Canada's opportunities to become a global water solutions leader.

Event participants explored how changing global water conditions are creating rapidly shifting demands and opportunities for innovation on many levels. The discussion focused on Canada's niche regarding best application of its water strengths and assets, as well as current business and government responses to water risks. We also identified potential next steps in terms of what is required for Canada to capitalize on its water strengths.

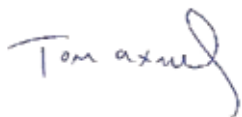
To help catalyze discussion, we invited David Crane, an award-winning Canadian journalist with a long-time interest in the interaction of innovation, economic development and environmental sustainability, to instigate conversations and debate through preparation of a discussion paper.

We sent the working document to a cross-section of key business, government and opinion leaders as a jumping off point for discussion. The draft paper has since been updated by the author based on key insights shared with him during the March 4th event and via email afterward.

This is the second in a series of reports prepared for the Blue Economy Initiative. We are working on two other "opportunity areas" to better understand the value of water in food and agricultural production, and to showcase a vision for a sustainable water infrastructure "city of the near future".

We invite you to work together with us to advance the ideas and actions for progress that are identified as a result of these discussions to ensure Canada realizes its potential to play a leadership role in addressing water-related challenges at home and abroad.

Sincerely,

A handwritten signature in blue ink that reads "Tom Axworthy". The signature is fluid and cursive, with the first name "Tom" being more prominent than the last name "Axworthy".

Dr. Thomas Axworthy
Chair of the Blue Economy Initiative
President and CEO of the Walter and Duncan Gordon Foundation

Preface

The Blue Economy Initiative (BEI) is a national project founded by the Canadian Water Network, the Royal Bank of Canada, and the Walter and Duncan Gordon Foundation.

Our long-term vision is for Canada to have a prosperous future as a global leader in water sustainability. We advocate for a national and global “blue economy” that recognizes all economic development should be pursued within a water sustainability framework.

Our mission is to catalyze well-informed water management decisions, policies and practices that ensure maximum social, environmental and economic benefits, and our overall goal is to build the case for water sustainability.

By producing discussion papers and convening events, we intend to catalyze discussion and action that will strengthen our understanding of the value of water, create broader awareness of the risks of failing to make sustainable decisions, and illustrate the opportunities and benefits of sustainable water management on a regional, national and global scale.

Two BEI documents have been prepared to date:

- A [**report entitled “Running Through our Fingers” by Renzetti, Dupont and Wood**](#), which looked at the state of Canada’s ability to adequately measure and account for the value that water contributes to the economy.
- An [**article by Henderson and Parker**](#), which articulated rationale for discussing whether Canada has what it takes to make progress in building a “blue economy”.

This next paper is designed to help frame and meaningfully advance a national conversation around Canada’s opportunities to become a global leader in water sustainability and innovation. This includes the development and application of water-related “resources” – knowledge, business skills and ingenuity – to implement a winning strategy with respect to best management and use of water.

This paper is divided into three sections:

1. An overview of the global water context and some of the opportunities and drivers for water innovation.
2. A snapshot of current water strengths, capabilities, assets, key players, and gaps that need to be filled to engender innovation, based on a realistic look at our “bench strength”.
3. Next steps and key questions that warrant further discussion around becoming a water solutions country.

The intent of the following paper is not to provide exhaustive research or a concrete strategy. Rather, this paper is meant to focus dialogue around options for implementable strategies and stimulate action by elucidating Canada’s opportunities.

Acknowledgements

We wish to thank David Crane for preparing this paper for the Blue Economy Initiative.

We would also like to show appreciation to reviewers for providing feedback and suggestions to improve earlier draft versions. These include: Zafar Adeel, Shari Austin, Tom Axworthy, Jean-François Barsoum, Alex Bielak, Margaret Catley-Carlson, Bernadette Conant, Diane Dupont, Simon Glauser, Nancy Goucher, Korice Moir, Tim Morris, Sandra Odendahl, Nicholas Parker, Lynn Patterson, Steven Renzetti, and Bob Sandford.

Thank you to the University of Waterloo Creative Services for design and layout.

Note on Author

David Crane is an award-winning journalist with a long-time interest in globalization and the interaction of innovation and economic development, environmental sustainability and social equity. He has honorary degrees from Wilfrid Laurier University and Victoria University, an Arbor Award from the University of Toronto and a citation from Conestoga College in Kitchener, Ontario. He is a director of the Technology Evaluation in the Elderly Network in the Networks of Centres of Excellence, a member of the Advisory Committee of the Canada-United States Law Institute, and a member of the National Statistics Council. He can be reached at crane@interlog.com.

A copy of this paper is available at <http://www.blue-economy.ca>. For more information, or to share comments on this paper, please e-mail us at info@blue-economy.ca.

Executive Summary

It was just over 20 years ago when the world acknowledged a looming water crisis. This was the Earth Summit, the 1992 UN Conference on Environment and Development held in Brazil, which led to the first World Water Day on March 22, 1993, now an annual event to highlight the importance of water in our lives. Some 20 years later, former Norwegian prime minister and respected environmentalist, Gro Harlem Brundtland, says that despite modest progress the world still needs to prepare for and to act “to prevent a potential freshwater crisis with respect to supply and quality.”ⁱ

The availability and quality of the world’s water supply is the overarching challenge facing human society in the 21st century. Water is essential for life – we can’t live for more than a few days without it – but it is also a finite resource. Moreover, water is also essential for food production, energy, industry and mineral development for raw materials. While we can substitute wind power for coal power and electric batteries for gasoline, there is no substitute for water.

Yet many parts of the world already face water shortages. The share of the global population threatened by severe water shortages could grow significantly over the next several decades. The demand for water will increase significantly as the global population expands from the current seven billion people to an estimated nine billion by 2050. The global economy, urbanization and income levels are also on the rise.

And then there’s a new threat: climate change. It is projected to seriously disrupt weather patterns, leading to more frequent and intense droughts and flooding, loss of water due to evaporation, and rising sea levels that invade freshwater estuaries and damage ecosystems.

With water spending expected to reach \$1 trillion a year by 2020, ours is a world where the need for water solutions will become increasingly urgent. But this is also Canada’s opportunity. If we make water our focus, Canada can become a leading water solutions country. If we combine our investment in research, our experience with water challenges, our water management systems, skilled workers and the array of Canadian companies that deliver water-related goods and services, Canada’s water potential is truly promising.

The world must adapt to a new water reality. Even in Canada, billions of dollars will need to be spent to upgrade and expand our own clean water and wastewater facilities (Canada will have another six million people by 2050), to create efficient water use and improve water treatment in the oil sands, potash and other resource industries. Canada must also address severe water conditions in First Nation communities and ensure water is used efficiently for agriculture and to protect our ecosystems. At the same time, Canada has the potential to attract investment for businesses that require access to reliable sources of water.



Canada has already taken some steps to advance its potential as a water solutions country. The 10 premiers and three territorial leaders of the Council of the Federation have adopted a Water Charter, established a Water Stewardship Council and a Water Partner Advisory Committee. Ontario has adopted the goal to become a leading water hub, inspired by the efforts of Singapore and Israel. Other provinces have also adopted ambitious water strategies. But what still remains to be seen is how those intents and strategies are implemented and missing from the picture is an aligning national vision, as the federal government is not at clearly leading the charge, and there are concerns over federal cutbacks in support of water research initiatives.

At the same time, we must build on Canada's strengths. We have world-class membrane technologies, ultraviolet water treatment systems, remediation systems, technologies to extract nutrients from wastewater, as well as competitive engineering and consulting firms. We have universities that are deeply engaged in water research, and are building test beds and demonstration systems to advance new technologies and accelerate commercialization.

Canada faces many water challenges as well, and technologies are one response to addressing these challenges. We are developing water companies with exciting new technologies, but their growth potential is limited because of a lack of capital, regulatory barriers that slow the introduction of new technologies, or unwillingness by public and private purchasers of complete water and wastewater systems to be early adopters of new technology. At the same time, we face challenges with growing smaller companies into much bigger companies with scale and scope for the global marketplace. We need to ensure that the pricing of water is sufficient to encourage water conservation and create a market for innovation, as well as ensure that Canadians have the cleanest water in the world.

We have the potential to address our challenges and become a water solutions country, working to help the world avert a global crisis, while at the same time creating companies and jobs that will help deliver the solutions. Crafting a strategy for Canadian success, however, will require significant, sustained commitment from both the public and private sectors.

A successful water future for Canada will also mean answering some key questions:

- **How do we build a national water opportunities strategy to mobilize our capabilities?**
- **How do we build global strengths by addressing our domestic needs for sustainable water management?**
- **How do we focus leading-edge research for results and build our research strengths?**
- **How do we grow Canadian companies so they can contribute to global solutions?**
- **How can we help Canadian entrepreneurs fund and commercialize new technologies?**
- **How can we develop our skill sets, from researchers to smart regulators, and managers to operators and entrepreneurs?**
- **How should we make greater use of pricing and other market mechanisms?**
- **How do we better connect with global partners?**
- **How can we use our water supply and water management to attract foreign investors?**
- **And most importantly, who will be the leaders and champions of this great Canadian opportunity?**

The world faces no greater challenge than that of meeting its future water needs. Canada can be part of the solution, a water solutions country – that's our decision to make, but we need to make it now.



1: Global Water Opportunities

A global water crisis is looming on the horizon. Population growth and ongoing economic expansion will confront an increasingly constrained water supply in many parts of the world. This is already generating the need for major changes in water management and innovation, and this need will become even more urgent if health, food and energy crises, and even the risk of conflict over water, are to be averted. The growing threat of climate change makes access to water an even greater challenge.

John Beddington, former chief scientific adviser to the British government, warns that “by 2030 the world will need to produce around 50 per cent more food and energy together with 30 per cent more freshwater, whilst mitigating and adapting to climate change. This threatens a ‘perfect storm’ of global events.”ⁱⁱ

The challenge is to prevent that “perfect storm”.

Yet the looming water challenge will also create significant opportunities for Canada to become a water solutions country. This will require a clear strategic plan with strong leadership and sustained commitment from both the private sector and government. Since the challenges are global, Canadian research, technology, systems management and solutions must be world-class.

A growing number of countries already see the opportunity to deliver water solutions and are investing in new technologies. Israel, the Netherlands, Singapore, Japan, Denmark, Germany, and the United States are just a few examples. Israel, for instance, is a leader in the development of drip irrigation, water management and wastewater reuse and desalination. Singapore is a global research hub, attracting significant private and public investment. Eleven of Germany’s world-renowned Fraunhofer Institutes have formed the Fraunhofer Water Systems Alliance to pool their expertise in the R&D of water infrastructure systems and technology.

In the United States, the state of Massachusetts has set its sights on becoming a major water technology centre; Ohio is developing a major research base; and Wisconsin is focused on developing itself as a global hub for water technology and research.

Multinational corporations such as Veolia, GE, IBM, Samsung and Hitachi, are also moving forward with water solutions.

All of this means that if Canada is to act, it must act now and advance its capacity for water opportunities in Canada.

According to Christopher Glasson, publisher of Global Water Intelligence, there are several reasons why 2013 is the time to advance the water industry and innovative technologies.ⁱⁱⁱ

- **For too long, water has been considered a “low-tech proposition”, but developments in nanotechnology, biotechnology and information technology could change that.**
- **The scale of the challenge is growing; as the availability of water in many parts of the world declines, the demand for water is increasing.**
- **The market is becoming global, with governments looking worldwide for solutions. Industrial users are also looking for water solutions, since both the price and regulation of water use is growing.**

Satellite images from space show our planet cloaked in water – and in a sense, it is. About 70 per cent of the Earth’s surface is covered by water. But over 97 per cent of this water is saltwater oceans and seas that require costly and energy-intensive desalination before people can use it. Freshwater – found in lakes, rivers, ice, snow and aquifers – constitutes only about 2.75 per cent of the world’s water, and much of that water is either out of sight in underground aquifers or stored in frozen glaciers. Less than one per cent of all the water in the world is present in fresh water ecosystems.^{iv}

Even so, the world has more than enough water to meet its growing needs. But too much of that water is not where it is needed, or is unusable because of pollution, or is threatened by climate change. In its 2013 Global Risks report, the World Economic Forum rates water supply crises the fourth most serious risk facing the world, up from its fifth place ranking in 2012.^v



A recent Bank of America Merrill Lynch report warns that “we have already arrived at peak water globally. The long-term supply challenges are vast and demand is projected to overshoot supply by 40 per cent in the next 20 years, with half of the world’s population living under conditions of ‘water stress’ by 2030.”^{vi} It projected the world will have to spend US\$1 trillion a year by 2020 to address water needs, double what it is spending today.

“Water looks set to become scarcer than oil, with potential for the supply and demand imbalance to manifest itself in increased domestic social unrest and trans-boundary disputes (30 countries on three continents are potential locations for future conflicts over water),” the report warns.

Other reports also project significant investment needs. Major consulting firm Booz Allen Hamilton has estimated the cost to meet water and wastewater infrastructure will total US\$22.6 trillion over 2005-2030.^{vii} But as the report said, the solution will require creative thinking, as well as money and technology. “At heart, we face a challenge of imagination. Solving the problem will require letting go of obsolete approaches to financing, governance and management – approaches that no longer work in our politically, technologically, and administratively complex society. We will need new incentives for planners and builders and new ways of decision rights exercised among dozens of related players from the public and private sectors.”

In its study on the world’s environmental outlook to 2050, the Organisation for Economic Co-operation and Development (OECD) notes that while the world has been dealing with environmental challenges, “the sheer scale of economic and population growth has overwhelmed progress in curbing environmental degradation. Providing for a further two billion people by 2050 will challenge our ability to manage and restore the natural assets on which all life depends.”^{viii}

At the same time, by 2050, the world economy is projected to nearly quadruple, which will mean major increases in the demand for food, energy, natural resources, and of course, water. The OECD warns that freshwater availability will be at risk in many countries around the world, with more than 2.3 billion people, or about 40 per cent of the world’s population projected to live in water basins experiencing “severe water stress.” The OECD expects global water demand to increase by 55 per cent, based on current policies and practices.

But the challenge is not only to ensure that a growing world population has access to safe drinking water and effective sanitation systems to treat water and prevent disease. Water is critical for energy development, mineral extraction and processing, food and food processing, pulp and paper, chemicals, cement and many other products and services.

That's why "freshwater scarcity stands out as one of the most pressing cross-cutting challenges. While global water withdrawals have tripled in the last 50 years, the reliable supply of water has remained relatively constant during the same period," Britain's Royal Institute of International Affairs warns in a report on challenges facing resource industries.^x The International Energy Agency stresses that in a world facing big increases in energy demand, and with energy development heavily dependent on water availability, future energy supply is "vulnerable to physical constraints on its availability and regulations that might limit access to it."^x Water is growing in importance as a criterion in assessing the viability of energy projects, the agency says.

The projected growth in cities around the world, especially in Asia, will also require an enormous amount of new investment for clean water and wastewater treatment.

As a McKinsey Global Institute study underlines, "we are quite simply witnessing the biggest economic transformation the world has ever seen as the populations of cities in emerging markets expand and enjoy rising incomes – producing a game-changing new wave of consumers with considerable spending power."^{xi}

The McKinsey study on growing urbanization projects that one billion new consumers will be added to the global "consuming class" by 2050, with 600 million of them in the world's Emerging 440 Cities. All these fast-growing cities will need clean water and sanitation. Municipal water demand will increase by 80 billion cubic metres by 2025, from 190 billion cubic metres a year to 270 billion cubic metres – 40 per cent higher than today's urban global level, the study says.

But this will also mean these cities have the opportunity to leap-frog technologies, moving to adopt the most advanced systems. It will also mean that these cities will need access to the best advice they can get on infrastructure planning and implementation.



This growth path to 2050, with an extra two billion people, economic growth and a significant shift to cities means “the volume of urban construction for housing, office space, and transportation services over the next 40 years could roughly equal the entire volume of such construction to date in world history,” predicts the United States National Intelligence Council, a think tank for the Central Intelligence Agency.^{xii}

With food and energy demand expected to soar, “tackling problems pertaining to one commodity will be linked to supply and demand for the others.” Measures to boost biofuel production will require significant water inputs and may displace needed food production. Underground drilling, or fracking, to boost oil and natural gas supplies, is heavily dependent on water, and carries with it the risk of contaminating groundwater reserves. Carbon capture and storage to reduce greenhouse gas emissions from power plants and oil sands projects also requires increased water use. Expanded use of pesticides and fertilizers to boost agricultural yields can increase polluted water run-off into water ways, threatening the potability of the water for human use.

In 2008, a group of companies that make extensive use of water founded the 2030 Water Resources Group. In a subsequent report, the group asked why the world was not showing greater urgency in addressing future water needs.^{xiii}

The group called for a greater sense of urgency, while also arguing that the global water challenge can be met – and solutions sustained – if the world gets serious enough. It contends that this is fundamentally a global management challenge, stressing that “we are not at the mercy of a scarce and variable natural resource.” Explaining why the private sector was taking up the cause of global water needs, the 2030 Water Resources Group report says that “growing competition for scarce water resources is a growing business risk, a major economic threat that cannot be ignored, and a global priority that affects all sectors and all regions. It is an issue that has real implications for the stability of the countries in which businesses operate and the sustainability of communities and the ecosystems they rely upon.”

This is why UBS, the Swiss banking group, suggests water scarcity is “the defining crisis of the 21st century.”^{xiv}



2: Identifying and capitalizing on Canada's strengths and filling the gaps

There are good reasons for Canada to want to become a world leader in delivering solutions to a looming global water crisis. And there are good reasons to believe it can be successful.

- **There is a large and growing global market**, now more than US\$500 billion per year, and headed towards US\$1 trillion per year as countries face the urgency of addressing water challenges. While much of the focus is on the needs of the developing economies, the United States and Europe will also be significant markets.
- **Canada itself is a significant growth market**, providing the opportunity to serve as an early adopter for new technologies and water management systems. Canada has a growing population and a need for significant investments to upgrade its water and wastewater systems. Over 2004-2008, Canadian municipalities generated \$16.7 billion in water sales, but spent \$18.4 billion on water purification, supplies, sewage collection and disposal, while investing \$11.8 billion in drinking water infrastructure, and \$10.4 billion on sewage collection and disposal infrastructure.^{xv} Moreover, there is growing population in Canada and the United States, which means even greater water needs during a time of intensifying climate change. By 2050, Canada could gain another six to seven million people, and the United States – another 87 million people.
- **Canada has a strong networked research base in our universities and research institutes** that can advance fundamental science for innovative solutions and provide evidence-based information needed for informed policymaking. That capacity is integrated nationally to improve the ability to focus directly on addressing practical water challenges through the Canadian Water Network, a national network of centres of excellence. Canada can also train the skilled people needed for an innovative water system, and be a source of new start-up companies.
- **Canada has a relatively high level of water infrastructure regulation and water management systems**, though we cannot claim to be at the leading edge in terms of implementing and enforcing them. The most recent Conference Board of Canada report on the environment ranks Canada 15th out of 17 peer countries overall, but ranks Canada fourth in water quality.^{xvi} But Canada could do much more to raise the quality of its water management and water and wastewater standards, which in turn would drive innovation. At present, water and wastewater measures vary widely from province to province, with Manitoba, Alberta and Ontario achieving better results than Québec and Atlantic Canada.^{xvii}
- **Canada has a growing number of competitive water companies** providing goods and services to world markets, including consulting firms and engineering companies that can design, engineer,

build and operate water projects. Canada also has companies – many of them niche players in global value chains – that can supply innovative, high-tech products or systems. (See appendix for a representative list of Canadian water companies.)

- **Canadian companies are going global**, both because they need larger markets to support niche technologies and because they have the consultancy or engineering skills to provide effective and affordable solutions for other countries. In a 2008 survey of 64 Canadian-based water companies, 51 per cent reported they exported to the United States, 18 per cent to Mexico, 16 per cent to Western Europe, 14 per cent to China, and 12 per cent to other parts of Asia.^{xviii}
- **Canada sits next to the largest single market for water technology and services.** While Israel and Singapore must struggle to find markets for their water companies, Canada has the advantage of having the United States market right across the border, and another growing market, Mexico, as a close NAFTA partner. China is a critical market, as is India. But the United States and Mexico represent next-door markets that should give Canadian companies an advantage.
- **Canada is building an infrastructure of test beds and new technology demonstration centres** to facilitate rapid prototyping and commercialization of new technologies and systems. One example is the Southern Ontario Water Consortium, intended to help companies develop, test and demonstrate new water technologies and services for local, national and global markets. IBM is providing \$20 million towards a major computing centre. Another example is RES'EAU-WaterNET, a Natural Sciences and Engineering Research Council (NSERC)-supported research organization that funds research projects focused on water treatment challenges in small, rural communities, including First Nations. The University of Calgary and the City of Calgary have partnered to create Advancing Canadian Wastewater Assets (ACWA) to develop and test new wastewater treatment technologies.
- **Canada is gaining experience in new forms of water infrastructure financing**, in particular with public-private partnerships. At the same time, funding programmes exist that enable Canadian water companies to pursue new technologies, such as the federal government's Industrial Research Assistance Programme and Sustainable Development Technology Canada. The International Science and Technology Partnerships programme helps Canadian companies partner with companies in Israel, India, China and Brazil.
- **Canada's strengths include a number of non-profits, committees and other groups that deal with water governance and related policy issues.** Examples include the Canadian Water Resources Association, among other groups, who has advocated for a Canada-wide water strategy. FLOW, the Forum for Leadership on Water, is a non-partisan group of water experts from across Canada who seeks a federal strategy to sustain our freshwater resources. The POLIS Project on Ecological Governance, based at the University of Victoria, addresses issues of governance and management in the environment, including a special focus on water sustainability and the water soft path. Others include Nature Québec, the Canadian Water Issues Council, the Centre for Indigenous Environmental Resources, Pollution Probe, WWF-Canada, and the Water Partners Advisory Committee. The C.D. Howe Institute also publishes research related to water pricing and allocation.

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- **There is political will at the provincial level.** In 2010, the Council of the Federation, representing the 10 provincial premiers and three territorial leaders, adopted a Water Charter.^{xix} In it, they agreed to strengthen water conservation initiatives, make water use more efficient, and encourage strong water efficiency and quality standards and regulations, including a Canada-wide water efficiency labeling programme. The Water Charter also aims to enhance water monitoring efforts and the sharing of information, and “encourage Canadians and Canadian companies to be leaders in the development and sale of new technologies and services for water conservation and protection.” In 2011, the premiers established a Water Stewardship Council and a Water Partner Advisory Committee to implement the commitments of the Water Charter.

Ontario shows how to do it



Ontario has declared its goal is to become a “continental water innovation leader”.^{xx} The Ontario Water Sector Strategy proposes to make Ontario “a strong exporter of products and services that solve water quality and quantity problems; a leading North American site for new water and wastewater technology innovation, demonstration and commercialization; and a leading adopter of innovative water technologies and financing methods”.

The Ontario Clean Water Agency, a provincial agency that manages, operates and maintains water and wastewater treatment facilities across the province, is playing a key role in implementing the Ontario Water Opportunities Act, including the testing, development and uptake of new technologies. It has held Technology Showcases to highlight advancements, and has an innovations committee to help entrepreneurs accelerate commercialization of new technologies. It is working with companies to help test and advance their technologies. Starting in 2014, the Southern Ontario Water Consortium will provide test beds for new technologies to demonstrate capabilities. The Bloom Centre for Sustainability brings public and private sector players together, in sectors such as food processing, for the adoption of sustainable water use. The Walkerton Clean Water Centre is also playing a role in technology development. The Ontario Centres of Excellence work with university and college researchers to develop water technologies and assist companies improve technologies. Ontario has also established WaterTAP (the Water Technology Acceleration Project) to help innovative water companies.

But Ontario is not alone

British Columbia is looking to update its Water Sustainability Act, following up on its Living Water Smart: B.C.'s Water Plan. Québec plans to step up its efforts “on the international scene by supporting and facilitating the export of its public and private expertise in the areas of water resources technology, management and protection.”^{xxi} In 2009 it passed a new water act, “The Act to Affirm the Collective Nature of Water Resources and Provide for Increased Water Resource Protection”. Ecotech Québec is a public-private non-profit partnership to advance Québec's cleantech industries, including its significant array of water companies.

In 2009 Alberta updated the Water for Life Strategy it adopted in 2003. The province's 2011 Alberta Research and Innovation Plan focuses on strategic initiatives that add value, with collaboration between government, industry and academia, focusing on pre-commercialization and knowledge transfer. Its priorities include improved and enhanced water treatment technologies, improving water productivity in the production of food, and water management systems for healthy ecosystems and safe and secure drinking water. Alberta Innovates – Energy and Environmental Solutions, is a government agency that supports water-related R&D projects.

Saskatchewan has adopted its 25 year Saskatchewan Water Security Plan to ensure “a sustainable water supply to support business and industry needs, a healthy environment and our quality of life.”^{xxii} It has established the Saskatchewan Water Security Agency to oversee implementation of the plan, with the intention of operating with a 25-year planning horizon.

Yet there is also concern that at both the federal and provincial levels, budgets are being cut, leaving water standards unenforced. Inspections, including inspections of municipal infrastructure and resource industries, are not being carried out on a timely basis, and infractions are not being followed up for compliance. The development of standards where gaps exist is being neglected, and that important data collection, in some instances, is badly out of date. Likewise, mapping of Canada's aquifers is said to be proceeding at a snail's pace, with completion not expected for one to two more decades.

A key driver for innovation, improved water management, water efficiency and conservation, is smart regulation that pushes water providers and water users toward better processes, systems and technologies. By striving to have leading-edge regulatory requirements – including smart regulators who can move quickly to endorse effective new systems and technologies, along with timely inspections and compliance with standards – Canada and its provinces can both create a stronger environment for innovation and add to our international credibility.

The key test in all provinces will be implementation, not just promises.

Turning needs into strengths

Meeting our own water challenges will help Canadian companies and entrepreneurs – aided by academic and government researchers – to develop world-competitive technologies.

Major challenges stand out:

Ensuring high-quality water and sanitation for Canadians

While Canadians generally enjoy access to clean water supplies, and many Canadian cities operate state-of-the-art sanitation systems, there are still significant gaps. Upgrading our own water and sanitation standards and systems will ensure all Canadians have access to clean water and that water is used more efficiently. We need smart regulators as well as smart companies. At the same time, improved inspection, enforcement and compliance measures, along with improved reporting on the state of water, are necessary.

Canada can do much more to implement water conservation practices and improve water-use efficiency. According to the OECD, Canadians are the second highest per capita water users among 29 member nations; only Americans consume more per capita. In fact, Canada has been criticized repeatedly by the OECD for excessive use of water.^{xxiii} Since 1980, the OECD notes that overall water use in Canada has increased by 25.7 per cent. In contrast, nine OECD nations, including the United States, Sweden, the Netherlands, Britain, Poland, Finland and Denmark, have reduced their overall water use.

From 2009-2010, 123 Canadian municipalities were surveyed about their drinking water systems, wastewater and storm water networks. The survey found “troubling trends in the conditions and management of Canada’s most essential public assets.”^{xxiv} Some 15.4 per cent of drinking water infrastructure, 40.3 per cent of wastewater infrastructure and 12.5 per cent of storm water management systems were rated “fair”, “poor” or “very poor.” Moreover, with new federal wastewater standards, the report states that “even ‘good’ or ‘very good’ wastewater infrastructure may require upgrading or replacement.”

The replacement cost for drinking water infrastructure rated less than “good” was estimated at \$25.9 billion; for less than “good” wastewater infrastructure, the costs reached \$39 billion; and for less than “good” storm water systems a replacement could cost \$15.8 billion, for a combined total of up to \$80.7 billion for all the projects. In addition, the cost of upgrading of wastewater plants to meet new federal regulations is estimated at \$20 billion. The survey of municipalities also found significant information deficits, including the state of drinking water and wastewater pipes.

A 2009 survey of Canadian municipalities found that 86 municipalities (accounting for about 2.5 million Canadians) had experienced water supply problems between January 1, 2007 and December 31, 2009, and that 206 (accounting for about 6.7 million Canadians) reported water quality problems during the same time period.^{xxv}

Addressing Canada’s own water/wastewater infrastructure and management needs and shortcomings, while meeting the world’s highest standards, would give Canadians companies a strong domestic market where they could develop and improve technologies as a first step towards serving global

TROUBLING TRENDS

123 Canadian municipalities

Survey 2009-2010 // drinking water systems // wastewater // storm water networks



15.4%



40.3%



12.5

rated: fair - poor - very poor

The Replacement Costs

Less than good conditions : drinking water // wastewater // storm water



Combined total \$80.7 billion

markets. The Canadian Water and Wastewater Association, which represents Canada's municipal water systems and their suppliers, says, "one of the greatest opportunities for reducing the costs of infrastructure replacement, now and into the future, is the consideration of new technologies", urging strong public support for technology development which, it says, "will ensure Canada's leadership in the water industry worldwide."^{xxvi} There is limited data on the size of the Canadian market, but a 2006 survey estimated Canadian water industry sales at \$7.8 billion, and the size of the Canadian market at \$8.5 billion; it estimated Canadian water industry exports at \$431 million and Canadian water industry imports at \$1.14 billion, with a trade deficit of \$710 million.^{xxvii}

Meeting the need for clean and efficient water use in the energy and mining industries, including the oil sands

As the Canadian Association of Petroleum Producers acknowledges, "as Canada's oil and gas industry grows, so does the demand on Canada's water resources."^{xxviii}

The oil and gas industry uses water in oil sands projects and in conventional oil fields, where water is piped down oil wells to flush out remaining oil to the surface. Water is also used in some natural gas deposits to extract gas out of tight positions. In addition, water is used in oil refining and significant volumes will be needed in hydraulic fracturing, or fracking, for natural gas or the extraction of shale oil.

With rapid expansion of oil sands output planned (from 1.6 million barrels a day in 2011 to a projected 4.3 million barrels per day in 2035), the International Energy Agency estimates that total water withdrawals for oil sands production will grow from 220 million cubic metres in 2010 to about 520 million cubic metres in 2035. The challenges are to 1) significantly reduce the volume of water required per barrel of oil sands output; 2) ensure the pristine quality of water before it is returned to its source as well as addressing the impact of air pollution on water; and 3) prevent chemical residues in tailings ponds from seeping into freshwater resources.



The federal and provincial governments have moved, albeit slowly, to improve the monitoring of water quality after a 2010 Oil Sands Advisory Panel report was critical of ineffective monitoring. The oil industry, meanwhile, along with specialized engineering and water companies, academic researchers and government laboratories, have been making progress both on the efficiency of water use and water quality.

For example, in 2010, seven oil companies formed the Oil Sands Tailings Consortium for joint research on new technology. In 2012, 12 oil sands companies formed Canada's Oil Sands Innovation Alliance (COSIA) to accelerate the development of environmental technologies and fast-track their adoption, working with universities, suppliers, and government in four priority areas – tailings, water, land, and greenhouse gases. The oil sands tailings consortium is now integrated into COSIA. As the Canadian Association of Petroleum Producers acknowledges, about 75 per cent of Alberta's oil production – conventional or oil sands – is water-assisted and total water use is expected to grow.”^{xxix}

Canada will also need improved regulation and reporting on fracking to retrieve oil and gas deposits. Other important issues include the regulation of on-site handling of chemicals, reports on chemicals employed and their risk factors, the impact of chemically-treated water on aquifers, and the disposition of fracking water.

At the same time, Canadian taxpayers face major bills for cleaning up contaminated water from abandoned mines, and there are concerns that federal practices have been giving too much leeway to mining companies to use lakes and rivers to dispose of wastes. The publicly-funded remediation costs for the abandoned Giant Mine in the Northwest Territories, where there are major accumulations of arsenic trioxide in tailing ponds and other contamination problems, could reach \$650 million.

At the same time, Section 36 of the federal Fisheries Act, which prevented companies from dumping harmful wastes into fish habitats, has been weakened. But high standards for resource and other companies, proper pricing of the water they use, and strict inspection/enforcement/compliance of laws and regulations, would not only address important challenges, but also create a market for Canadian companies developing new technologies.

The knowledge gained in Canada by effectively addressing the water challenges of the oil sands and other resource industries has the potential to create export opportunities for Canadian companies and to find applications in other sectors. Canada's resource sector is a significant market for Canadian water companies, with technologies developed here often finding new markets from the United States and Chile to Central Asia and Australia, as well as to other industries. As a report on Canada's water industry said, “Canada's mining, oil and gas and pulp and paper industries have proven good breeding grounds for water and wastewater treatment technologies, some of which are being applied to a wider range of industries.”^{xxx}

Dealing with the impact of climate change and adaptation

Climate change will have a significant impact on global water supplies and needs. It is expected to lead to higher sea levels and more violent storms, bringing saltwater into freshwater estuaries and threatening ecosystems. Climate change could also mean more frequent and intense heat waves that increase both flooding and droughts, and contribute to higher rates of evaporation from freshwater supplies, lowering water levels in the Great Lakes and major river systems such as the Columbia River system and water reservoirs, including Lake Diefenbaker in Saskatchewan.

Highlighting the risks to water systems from climate change, the United States National Science Foundation (NSF) is funding major research projects on water sustainability and climate change. “Despite the importance of water to life on Earth, there are major gaps in our basic understanding of water availability, quality and dynamics and the impact from both human activity and variable climate on the water system,” the NSF says.^{xxxi} The key question is how to protect ecosystems and better manage and predict water availability for future generations given alterations to the water cycle caused by climate variability and human activities, the NSF says.



A Natural Resources Canada report on climate change warns that “some of the most significant and pervasive impacts in Canada will be related to water resources.”

“Water stressed areas will expand due to decreased runoff in many areas resulting from changes in precipitation and increased evapotranspiration, while reduced water quality and quantity will be experienced on a seasonal basis in every region of Canada.”^{xxxii}

Moreover, it warned, “increasing demands on water resources for agriculture, energy production, communities and recreation will have to be managed in consideration of ecosystem needs”.

Much more must be done to transition Canada to a low-carbon economy. But even if Canada adopts a more responsible climate change strategy, more attention will also need to be paid to water adaptation strategies, including underground storage of water, the reuse of wastewater, collection and use of rainwater, improved efficiency in the use of water in industry and agriculture, the use of smart water metering to monitor use, and improved systems to reduce water loss due to leakage. Addressing these needs will enable Canada to develop the skills and knowledge to serve global markets.

Ecosystem management

Ecosystems deliver a wide variety of services that are fundamental to human well-being. But as the National Roundtable on the Environment and the Economy (NRTEE) warned, “Canada’s ecosystems cannot function properly without adequate, reliable, and clean sources of freshwater.”^{xxxiii} Yet there is a danger that urban sprawl, climate change and water withdrawals could put major ecosystems at risk because their value is not widely understood, with the result that essential services provided by ecosystems will be significantly weakened or lost.

Ecosystems are centered on watersheds, which are defined as areas of land that intercept and drain snow and rainfall through a particular river system or group of river systems. The NRTEE says, “all the land that is connected by rivers and streams could therefore be considered a watershed.” Examples include the Great Lakes, the Georgia Basin (which includes not only B.C.’s Strait of Georgia and Strait of Juan de Fuca, but all of the lands and watersheds draining into the Strait), the Oak Ridges Moraine in southern Ontario, the St. Lawrence River basin and the South Saskatchewan River basin.

Canada’s success in managing critical ecosystems, and developing effective remediation technologies for threatened ecosystems, will enable consultancies, engineering firms, technology providers and academic research institutes to gain the knowledge and experience they will need to help address intensifying ecosystem challenges in many other parts of the world. Growing urbanization will put more pressure on ecosystems in Canada and around the world.

Meeting the water and sanitation needs of First Nations and other remote communities

The shocking lack of clean water and sanitation systems in First Nation communities is well-documented. The National Assessment of First Nations Water and Wastewater Systems surveyed 4,000 on-reserve systems in 2009-2011.^{xxxiv} Some 39 per cent of the water systems were classified “high overall risk” and 34 per cent were “medium overall risk”, while 14 per cent of the wastewater treatment systems were high risk, and 51 per cent medium risk.

“In a 2011 report to Parliament, the Auditor-General of Canada found some progress had been made towards establishing a regulatory framework for First Nations water quality, but warned that even with a new regulatory framework, “First Nations reserves may still be years away from having drinking water comparable to what exists off-reserve in Canada.”^{xxxv}

More than money is needed to address the problems of First Nations and remote communities. It’s important to have an understanding of water management systems and their operation, along with trained operators, access to help on the management and operation of clean water and water treatment systems, and diffusion of new technology. With funding assistance from Aboriginal Affairs and Northern Development (2010-2014), the Federation of Canadian Municipalities is running the First Nations-Municipal Community Infrastructure Partnership Programme. The Federation has developed model service agreements for co-operation between municipalities and First Nations and also provides training programmes to bring First Nations and municipalities together to develop partnerships.

But this is also an area rich in possibilities for innovation. This was reflected in July 2011, when the federal and Ontario governments announced the Canada-Ontario First Nations Pilot Initiative to Improve Drinking Water Quality, an initiative designed to encourage “innovative and alternative



drinking water systems” which, if successful, can be adopted by First Nation and remote communities elsewhere in Canada. Participating communities, working with representatives from First Nation communities and federal and Ontario officials are seeking design and technology solutions. Ontario First Nations Technical Services Corporation, a technical advisory service for all 134 First Nations in Ontario, is providing support for the federal-Ontario pilot programme.

The urgent need to find innovative water solutions for First Nation and remote locations represents an important niche opportunity for Canadian water companies, with the possibility that systems found to be effective in Canada could have applications in other parts of the world.

At the same time, in addition to the public-health issues related to water, First Nations are also concerned about the environmental-health consequences of our decisions on the environment. They would like a greater say in setting environmental standards for resource development projects, especially in the Canadian North, and in decisions on mining and pipeline approvals. They want to be treated as partners in the process.

Training

Canada's universities and colleges have the potential to offer training programmes not only for technicians and managers of clean water and wastewater treatment facilities, but for researchers and regulators to meet our own future needs for highly qualified people. These trained individuals could also help other countries, especially those in the developing world, to meet their skills needs.

One example is the WATER (Watershed and Aquatics Training in Environmental Research) programme at the University of New Brunswick, funded by NSERC, which trains highly qualified researchers and practitioners from Canada and other countries in aquatic and watershed sciences to help meet the global demand for water research employees. The funding is for six years, from 2011 to 2017.

In 2012, a group of Ontario colleges led by the Centre for Alternative Wastewater Treatment at Fleming College, established the Canada-India Water Training Consortium to provide training for operators in the planned sweeping and urgently needed expansion of India's water and wastewater sectors. It has already run programmes in India.

Likewise, the Centre for Indigenous Environmental Resources, a non-profit organization established by First Nation Leaders from across Canada, works with University of Manitoba in running a two-year accreditation programme for First Nations students to raise First Nations' capacity building, as well as delivering other environmental training and consulting services for First Nation communities. It is also running its “Our Water – Our Future” project to train indigenous youth as future water leaders.

Making Canada a major training base to meet the world's future needs for skilled water operators and regulators could be an important opportunity for Canadian colleges and universities and other water agencies such as the Walkerton Clean Water Centre.



Using water to attract foreign investment and jobs to Canada

Access to reliable sources of clean water will become increasingly important in business investment decisions. Canada could become one of those countries that will be increasingly attractive for investment for companies that need access to reliable supplies of water, whether it's clean water for food processing, semiconductor manufacturing, or partially-treated water for resource projects.

The World Business Council for Sustainable Development emphasizes the risks to business as water becomes scarcer, "Water is a necessary input in the manufacture, delivery and use of virtually all products and services. Almost all companies are affected by uncertainties, tensions and dilemmas associated with their water consumption and use. A water-constrained world possesses significant risks for business worldwide." ^{xxxvi}

A report from the HSBC global banking group concludes that, "assessing country water vulnerability is a necessary exercise, because we believe that access to and use of water will increasingly become a differentiating factor for both economic productivity and the ability of companies to operate, and water will increasingly be captured as a measure of value." ^{xxxvii}

Canada has historically attracted significant investment from the aluminum industry in Québec and British Columbia, in part because of affordable hydro-power from abundant water supplies. The food processing industry in Ontario and Québec is another industry that relies on reliable access to clean water. Some provinces, notably B.C., Manitoba and Québec, deliver significant exports of electricity based on sizeable hydropower systems. Canada's tourism industry also depends, in part, on Canada's image as a country of clean rivers and sparkling lakes.

But Canada also has its own water restraints, meaning creative approaches are sometimes needed. For example, Vale, the Brazilian mining giant, is able to proceed with a planned potash mine in Saskatchewan after overcoming its difficulties in arranging reliable water supplies by contracting to use partially-treated water from Regina's water sanitation system, something Shell Canada does with Edmonton to meet its water needs.

The world's future water needs

In formulating an effective national water opportunities strategy, we need to understand where future opportunities will be:

- **Water loss management.** An United States market study says "water 'loss management' services and control technologies seem to be one emerging segment of the market – products and services geared to locating, measuring, and repairing the vast water losses that can occur due to decaying underground infrastructure." ^{xxxviii} Technologies include surface leak detection systems, robotic and video pipeline monitoring systems, and pipeline restoration systems, as well as smart metering of water use. Deteriorating water infrastructure systems mean that the world, including Canada, faces significant clean water losses through leakage (Montreal is estimated to lose some 40 per cent of its water through leakage). Recovering this "lost water" is often described as "non-revenue water". It can often be more cost-effective to restore existing systems than to build new ones. According to Environment Canada, leakage and system maintenance account for 13.3 per cent of water produced in municipal water systems. ^{xxxix}
- **Improved water use in agriculture.** Innovative systems and technologies for measuring and implementing more efficient use of water in agriculture represent a significant need as agriculture accounts for 70 per cent of worldwide water use, with irrigation a major reason for this. With a growing risk of drought conditions in many parts of the world, conserving irrigation water and using it more efficiently is a must, as is the development of drought-resistant crops and dry climate agricultural practices.
- **New technologies and systems for rainwater harvesting.** Another challenge is the collection, storage and efficient use of rainwater before it is lost to storm water sewer systems or runs off into waterways. Much of the clean water treated for safe human consumption is used to flush toilets, water lawns and wash cars. Stored rainwater or reused water from dishwashers and clothes washers could be used for some of these functions. Water recycling and reuse is another opportunity for new technologies and systems. "An off-shoot of this is the move to 'green

infrastructure’ – design and construction techniques to more effectively utilizing storm water and keeping the runoff out of the sewer system. This includes things such as more porous pavement, green roofs, new urban park design and so on – approaches geared to slowing it (storm water) down, spreading it out, and soaking it in.”^{xi} The Ontario Building Code has been revised to enable greater use of rainwater harvesting, but other jurisdictions still lag.

- **Water conservation and efficiency.** A reduction in demand, in effect, equals new supply. Clearly, addressing leakage in water systems is one answer, but others include a range of home-based systems that reduce the water needed to flush toilets, run tap and shower systems, and utilize less water in dishwashers and laundry equipment.
- **Water needs for a growing global resources market.** The needs of Canada’s resource sector – from oil and gas and mining to pulp and paper – are driving technology development here. The mining industry, for example, needs water to recover many different minerals, including gold, copper, uranium, diamonds, zinc and potash, while open-pit mines are also heavy water users, all with a need to clean and recycle water, access water and ensure environmentally acceptable tailing ponds. The pulp and paper industry’s need for water systems is significant, as is the oil and gas industry. Globally, industrial expansion will increase the demand for many resource products, which in turn will create market opportunities for Canadian water companies.
- **Incremental innovations will continue to drive key systems.** Incremental innovations, rather than radical new technologies, are likely to lead the way in finding new solutions. Canada is well positioned to continue advances in reverse osmosis membrane systems and ultraviolet technologies as a technique to disinfect and clean water. One new field is wastewater resource recovery – systems that not only treat water “but also recover valuable components, like phosphates, out of wastewater streams – not only because they promote undesirable biological activity downstream, but also because natural phosphate availability is rapidly declining.”^{xli} Canada has a number of companies in this field.

Indicators of Canadian success

While much needs to be done to ensure that Canada has the capabilities to be a successful global water champion, there are some indications that Canada can be a global water opportunities solution provider.

For example, in its 2012 list of the Global Cleantech 100, the California-based consultancy, Cleantech Group Inc., named 11 companies in the water and wastewater category, and three of them were Canadian. To be included in the list, companies have to be those that “are most likely to have big commercial impact in a five to 10-year timeframe.”^{xlii} In another listing by a United States non-profit consultancy specializing in water technologies, The Artemis Project, two Canadian water companies were among its top-five water technology companies and five Canadian companies among its top

50 water companies. And in a forecast of the 10 emerging technology companies to watch in 2013, Boston-based Lux Research included two Canadian water-related companies, N-Solv and Enbala Power Networks.^{xliii}

Building on our strengths

In a report on innovation-based businesses, the Conference Board of Canada found that water represents an opportunity for Canada. But it contends that Canada should focus on its established strengths – “water management, which includes quality enhancement, filtration and desalination, transmission and usage efficiency, metering, and system management.”^{xliiv} These technologies include ultraviolet disinfection of water, membrane technologies, technologies for the anaerobic treatment of sludge from municipal and high-strength industrial waste water, treatment of bio-solids generated in the waste-water treatment process, desalination techniques for purifying sea water, brackish water, and waste water, as well as services expertise in consulting, engineering, quality analysis and construction and water information systems and software. The report states that Canada has about 100 firms that specialize as water technology suppliers, mainly small and midsize companies.

Canada also has highly-competitive engineering companies that can design, engineer and build world-class water facilities. In fact, Canadian-designed and built projects can be found in many parts of the world. Engineering firms can become platforms to carry niche Canadian water technology companies into global markets and global value chains.

But ensuring an environment for sustained innovation is critical. “Innovation has a major role to play in promoting sustainable water resource management,” as the OECD says in its OECD Environmental Outlook to 2050.^{xliiv} “This includes (but not limited to) technologies. Examples include efficient irrigation systems and ecological farming techniques to reduce fertilizer run-off, crop research, water treatment technologies such as membranes and filtration techniques, and advanced wastewater treatment.”

But as the OECD also emphasizes, “technologies need to be supported by innovative business models and corresponding regulatory regimes to improve water management, and to integrate water priorities into other policy areas such as energy, food, and spatial planning.”

We should also ensure a capacity for radical innovations and demonstration projects. One example is the Dockside Green community, backed by Vancity, one of Canada’s largest community credit unions, which has developed a next generation mixed-use complex on the Victoria, B.C. waterfront. It shows how smart water innovations dramatically reduce freshwater needs. Projects of this sort are essential to demonstrate what can be accomplished and inspire further innovation.

Deepening our research capabilities

Sustaining and growing our research capabilities are essential both for Canada to address its own water challenges and to meet global needs and opportunities. Canada has many higher-education institutions devoted to water research, as well as government agencies and laboratories. Yet there is concern that Canada is weakening its research capability, particularly through research funding cutbacks by government.

Canada's active base of water research in our universities includes: Brock University's Water Economics, Policy and Governance Network; the University of Saskatchewan's Global Institute for Water Security; Guelph University's Centre for Applied Groundwater Research; the planned International Water Excellence Centre at Western University; University of Waterloo's Water Institute; the Programme on Water Governance at the University of British Columbia; the University of Toronto's Program on Water Issues, and its Drinking Water Research Group; the Canadian Rivers Institute at the University of New Brunswick; the University of Alberta Water Initiative; the Worsfold Water Quality Centre at Trent University; the Centre for Alternative Wastewater Treatment at Fleming College, as well as the Canadian Water Network, a Network of Centres of Excellence, to give just some examples.

NSERC has a key role to play as the key federal funding agency for university-based water research. Under its Strategic Network Grants, NSERC is giving high priority to water management and ecosystems, challenges it finds to be complicated by high energy costs and climate change. Research topics include enhancing ecosystem services, optimizing water use in industry, and ensuring secure community water systems. Over the past five years it has supported about 100 water-related research projects at universities. Over 2011-2012 it funded \$54.1 million in water-related university research. NSERC-funded research can lead to the creation of new companies, such as Ostara Nutrient Recovery Technologies, which grew out of NSERC-funded research at the University of British Columbia. NSERC is also funding 13 water-related Industrial Research Chairs at universities; these chairs are co-funded by other partners, including the corporate sector.



It is important to ensure that this research base is sustained and expanded so that Canada is well-positioned to advance fundamental science, provide evidence on the state of our waters and how to improve their condition, educate and train a high-quality water workforce and help develop new technologies that have the potential for commercialization. This is why reduced support for research is so disturbing.

Expanding our global links

The pursuit of foreign connections – for researchers, research institutes and companies – is also important if Canada is to become a global water opportunities nation.

Over the past decade the Canadian International Development Agency (CIDA) has allocated about \$750 million to support water and sanitation in the developing world, with a modest rise over time, from an average annual disbursement of \$66 million in 2002-2003 to 2006-2007, to an annual average disbursement of \$82 million from 2007-2008 to 2011-2012. Development projects for water and sanitation have remained fairly constant, at about 2.5 per cent of overall aid spending.^{xlvi}



Canada's aid programmes on water and sanitation can create opportunities for Canada for-profit and not-for-profit organizations. In a \$30-million CIDA project, Cowater International Inc. of Ottawa aims to boost sustainable water and sanitation services in up to 20 small towns in Ghana. Cowater is a consulting firm that works on water and sanitation projects in many parts of the world. In another CIDA project, the Centre for Affordable Water and Sanitation Technology, a Calgary non-profit, is establishing training centres to improve drinking water, sanitation and hygiene for children's health in Afghanistan, Nepal, Haiti, Laos, Zambia, Cameroon, Cambodia and Ethiopia.

CIDA also funds a programme of the Federation of Canadian Municipalities that sends water and other municipal experts to developing countries to deliver Canadian know-how and advice.

Canada's science and technology pacts with other countries also offer opportunities for Canadian companies and academic researchers to develop ties with foreign counterparts. Through the federally-supported International Science and Technology Partnerships Canada (ISTPCanada), we have bilateral S&T cooperation agreements with China, India and Brazil as well as a partnership with Israel. The Ontario and B.C. governments are also supporting ISTPCanada, which includes water as one of its activities.

In 2011, ISTPCanada hosted a China-India-Israel-Canada roundtable on sustainable water management through nanotechnology in Edmonton and an Ontario (Canada)-India-Israel Trilateral Roundtable on Water Technologies in Toronto. Participants pledged to follow up with collaborative R&D projects and student exchanges.

Foreign missions are another example. On his 2012 trip to India, Prime Minister Stephen Harper promoted the role of Canada's water sector. The new Canada-India partnership for multidisciplinary research, led by the Universities of Alberta, British Columbia and Toronto, will link researchers in both countries to focus on safe drinking water. The prime minister also participated in the official signing of the Canadian Business and Technology Facilitator entry into the massive US\$100 billion Ganges River clean-up project. CBTF signed a letter of agreement establishing a partnership to enable Canadian companies to contribute technology and training.

Canada also hosts the United Nations University Institute for Water, Environment and Health (UNU-INWEH) at McMaster University – this is the UN's think tank for water. Some of its core plans to counter the global water crisis are to focus on capacity development in developing countries, the facilitation of knowledge networks to identify and disseminate new knowledge in water management and governance, and research and policy development. UNU-INWEH also assists individual countries in addressing challenges in water management and governance. Its focus is on freshwater ecosystems, coastal ecosystems, dryland ecosystems and the water-health nexus.

Given Canada's close relationship with Mexico, and Mexico's urgent water needs, water could be added to the list of sectoral partnerships under the Canada-Mexico Partnership programme.

Cross-border university research partnerships are also important. One example is the Drinking Water Research Group, linking the University of Toronto, Dalhousie University and University of Indiana on the treatment, distribution and innovation challenges to meet future water needs and compliance. There are also research initiatives connected with other parts of the world, for example, the Water Institute at the University of Waterloo has research agreements with the Helmholtz Centre for Environmental Research in Germany, and the University of Sao Paulo in Brazil.

Key challenges

The need for a national vision and framework

While several provinces are showing leadership individually and collectively through the Council of the Federation Water Charter, the federal government is largely absent from the development of a water opportunities strategy, and may even be undermining Canada's capabilities through cutbacks in environmental research. To be effective, Canada needs a national "water vision".

While the 2007 Speech from the Throne pointed to the federal government's plans for a national water strategy for Canada, little has been heard since. A Canada West Foundation report by Robert Gibbons and Larissa Sommerfeld notes that while advocates of a national energy policy have had great success in attracting the attention of policymakers in Ottawa, advocates of a national water policy have had much less success even though water is much more integral to Canada's well-being.^{xlvii}

A national water strategy, with high nationwide water standards and regulations, would create an efficient national market and make it easier for Canadian researchers and water technology companies to develop water management systems and technologies for use across the country. The challenge, then, as they see it is "to figure out how best to engage a federal government that appears to have limited enthusiasm for grand national projects," the Canada West Foundation report said.

One alternative is a bottom-up approach, led by the provinces and key water users, that would demonstrate the collective need and desire that would eventually compel the federal government engage more fully and take up the water challenge as a national priority.

Sustaining and growing our knowledge/research base

Pursuit of a water opportunity strategy depends critically on an informed and engaged public, aware of the true state of our water resources and the pressures on them, as well as sector leaders, including key water users (municipalities, food processors, mining and oil and gas companies, for example) with focused data and analysis. It also depends on a strong research base – in our universities and government laboratories – that develops the tools and knowledge to monitor the state of our water and ecosystems, identify future risks (including those from climate change), advance our understanding of governance, legal and water management systems issues, pursue fundamental water science, help develop new water system technologies and train the next generation of water researchers, system engineers, water system operators and water entrepreneurs.

No system exists to provide Canadians with regular and reliable reports on the state of the country's water, the risks we face from new contaminants in water supplies, the threats to ecosystems, the challenges of climate change or other risks. For reasons of transparency and accountability, as well as making for a better informed public, there is a glaring need for regular reporting on the state of our water.

Canada's universities and government laboratories have shown they have the capacities to conduct world-class research. Yet this is at risk. Government cutbacks have significantly impacted environment programmes, with layoffs and withdrawal of support for major laboratories and research organizations, even disbanding the National Roundtable on the Economy and Environment. The Canadian Foundation for Climate and Atmospheric Sciences, which has conducted significant research affecting Canadian water, lost its federal support effective March 31, 2012. The Experimental Lakes Area, which conducts research on entire lakes and their drainage basins, is also losing its federal funding. In addition, Environment Canada has announced it will no longer publish surveys of municipal water pricing or municipal water use despite declaring in its most recent – and final – report on municipal water use that “understanding how Canadian communities use water is a prerequisite to gauging Canada's progress towards the sustainable use of its water resources”. It also noted that the federal municipal water surveys provided “information that allows the public, water managers and policy-makers alike to measure and compare different aspects of water use in the municipal sector, and to make informed decisions concerning our valuable water resources and water infrastructure.”^{xlviii}



At present, there is no overarching federal strategy on water research and support for researchers. A lack of leadership and cutbacks in research support mean that Canada risks falling behind at a time when water issues are more urgent than ever. Likewise, cutbacks have meant that water data is not being collected. There is no ongoing database of water use, demand, quality and related issues, and there is also a disturbing trend to prevent government scientists from discussing their research publicly.

The need to grow small Canadian water companies into midsize and big companies

Many Canadian water companies are small, which means they face serious challenges in attracting the attention of potential customers or investors, teaming up with large system integrators, building the cash flow to invest in growth, finding the management strength they need, and finding management time to pursue foreign markets. But if the industry remains fragmented, The Conference Board of Canada warns, “Canada will miss out on the full range of commercial opportunities for the technological advances Canadians have developed.”^{xlix}

Looking at cleantech companies overall (including water companies), a major survey found Canada was weak in creating a critical mass of high-growth companies with the potential to become global players. The survey found Canada especially weak in being an early adopter of new technology, including a lack of sophisticated domestic buyers interacting with technology companies, and only limited interest by entrepreneurs and investors to convert academic research into commercial products.^l

Canada will be hard-pressed to become a major player in the global water market unless it can succeed in facilitating the growth of larger water companies with the right scale and scope for the global market place. Not only do many Canadian companies have serious difficulty making the transition from small to medium and from medium to large, but small companies with promising proprietary technology can easily become takeover targets for multinationals, especially when Canadian companies face problems raising patient or long-term capital for growth. For multinationals, the takeover of promising small companies is part of their own innovation strategy.

Finding the capital to meet Canadian and global water infrastructure needs.

The infrastructure needs are certainly there. The federal Green Infrastructure Fund, part of the federal stimulus package, will provide \$1 billion over 2009-2014 for wastewater infrastructure, green energy, solid waste disposal and carbon transmission and storage. Municipalities had the opportunity to obtain water-related funding, with nine projects approved for wastewater treatment facilities and upgrades, with a federal^{li} contribution of \$245.3 million towards municipal projects totaling \$851 million. There is take-up when infrastructure funds are available.

A key challenge going forward is to find the capital to meet global infrastructure needs, with governments constrained due to efforts to restore fiscal health.

Canada is building some experience and expertise in public-private partnerships (P3) to attract experienced designers, builders and operators of water, wastewater and distribution networks, as well as private capital for water projects, an expertise that is potentially exportable. The federal PPP Canada Fund, for example, is helping to finance: a water and wastewater treatment facility in Kananaskis, Alberta; a biological nutrient removal wastewater treatment facility in Lac La Biche, Alberta; a biosolids energy centre as part of Victoria, B.C.'s Core Area Wastewater Treatment Programme; and a new organics biofuel facility for Surrey, B.C. Public-private partnerships are a way to finance public infrastructure, with the private sector assuming a major part of the cost and risk in developing and delivering infrastructure projects and then maintaining them according to agreed performance standards.

However, this approach has not been widely used so far. For municipalities facing financial constraints, the most promising potential model is the Design-Build-Finance-Operate-Maintain model, where the company winning the contract both supplies the capital and assumes the risk while ownership goes to the municipality. A study by PPP Canada concluded that for a growing use of the P3 model there needed to be "a robust market of service providers" so that competition would drive innovation and lower costs for municipalities.ⁱⁱⁱ The study concluded that there was a market of qualified service providers but that Canadian banks were an issue because they did not provide long-term capital for P3, though some foreign banks do. The report found that P3 is still a new idea and that public concerns over private participation in water were still a challenge, while municipalities lacked in-house knowledge to pursue P3.

EPCOR, a company owned by the City of Edmonton, is one example of a successful Canadian company active in P3. It is building and operating water and wastewater plants not only in Canada but also the United States.

Another financing option for municipalities is to see the reuse of wastewater as a business opportunity, selling partially-treated water to industry users, extracting valuable materials such as phosphorous and metals from wastewater, utilizing energy possibilities from wastewater gases and exploiting biosolids for agricultural use, as well as using this water for irrigation. The reuse of water can reduce the need for fresh water for irrigation, industry and other uses, and can also be a source of revenue to help finance water systems. Currently, only 3.3 per cent of Canadian municipalities (accounting for 3.9 per cent of the population served) report taking part in any wastewater reclamation or reuse, and only 2.8 per cent of municipalities (accounting for 13 per cent of the population served) report taking part in any stormwater reclamation or reuse.ⁱⁱⁱⁱ Larger municipalities with 500,000 or more residents report greater use – 22.2 per cent report using wastewater reclamation or reuse and 33.3 per cent report taking part in stormwater reclamation or reuse.

Water pricing, with charges based on volume consumed, is growing among municipalities, and there is clear evidence that residential and commercial/institutional users use less water when they are charged by volume rather than paying a flat rate.^{lv} In 2009, at an average consumption level of 25 cubic metres per month (the average consumption of a three-person residence), the average charge for metered systems was \$53.39, or 24 per cent more than the \$42.91 charge in 2006. Yet research

suggests that Canadian municipalities are far from full-cost accounting in water, so there is more room to capture revenue. At the same time, international comparisons show that Canadian water and sewer rates, on average, are “significantly lower” than rates in other OECD countries. While per capita water use is declining in Canada, higher rates would provide an additional incentive for water efficiency and conservation systems.

Making Canada an early adopter of innovation

A lack of enthusiasm for early adoption of new technologies by Canadian users and customers appears to be a major impediment for innovative small and midsize companies. Just 47 per cent of Canadian water and wastewater executives surveyed believed Canada was an early adopter of new water technologies, compared to 84 per cent for the United States, and 63 per cent for Asia, according to a SDTC study. Canadian entrepreneurs are faced with a serious problem because Canadian users – public and private – “do not readily buy from small, globally competitive Canadian clean technology companies.”^{iv} Since Canada trails the United States and the European Union as an early adopter of new technologies, small Canadian companies may have to find a foreign customer first or sell their business to a foreign competitor.

A key problem is risk aversion on the part of users, especially municipalities but also industry and individuals, in trying new technologies. One solution may be a “seal of approval” from a rating entity that grades the new technologies on their reliability. But smaller companies are also confronted by the desire of some systems integrators and engineering companies to reduce rather than grow their lists of suppliers.

Improving access to capital to grow our companies

Not only is there less availability of venture capital than in the United States, but the level of funding is typically smaller, meaning promising Canadian companies may be undercapitalized, limiting their capacity for growth. According to the SDTC study, for every \$1 that a Canadian company is able to raise in venture capital a comparable United States company can raise \$3; in 2008, the average venture capital investment in a Canadian clean technology company was \$7 million; in the United States it was \$35 million.

Indeed, without significant federal and provincial government participation, the venture industry in Canada would be much smaller. For example, Saltworks Technologies has used B.C.’s Innovative Clean Energy Fund for capital, and the federally-funded Sustainable Development Technology Canada SD Tech Fund has also been a key source of funding for technology development for a number of water-related companies.

Canada’s most prominent venture fund targeting the water sector is XPV Capital Corp. in Toronto, with a portfolio of Canadian and United States water companies including, in Canada, newterra Environmental Group and FilterBoxx Water and Environmental Group. Managing partner David Henderson believes regulation can drive innovation and credits the 1972 Great Lakes Water Quality

Agreement with sparking the creation of Trojan Technologies and Zenon Environmental, two of Canada's most successful water start-ups. Henderson co-authored a visionary report that helped lay the foundation for Ontario's water strategy.^{lv}

But a more broadly-based pool of capital for growth-oriented water companies is vital. However, interest may be growing. The UK water publication, Global Water Intelligence, reports a rising level of investor interest in 2012, pointing to 53 venture investments in water companies, including several in Canada.^{lvii} The Canadian companies included Ostara Nutrient Recovery Technologies (\$14.5 million), newterra (N.A.), FilterBoxx Water and Environmental Corp. (\$3 million), Saltwater Technologies (\$1 million) and Axine Water Technologies (\$1.5 million). Canadian water companies are also looking beyond Canada to raise equity. In 2008, for example, Ostara Nutrient Recovery Technologies raised US\$10.5 million from VantagePoint Ventures in Silicon Valley and Foursome Investments Ltd. from London.

Sustainable Development Technology Canada (SDTC) is an important source of funding for water technology companies as well as companies developing a technology for another purpose but which also have water implications.

SDTC is funding 27 water technology projects, to date providing \$58.2 million in support for technology development projects with a total cost of \$198.6 million. Examples include Pure Technologies Ltd., which is leading a consortium to develop robotic devices that can detect water pipe systems for leaks; ENDETEC (formerly Pathogen Detection Systems and now a subsidiary of Veolia), which is developing a portable on-site microbiological water monitoring system to detect E.Coli and Total Coliforms in water; Saltworks Technologies, which is leading development of a desalination system that reduces electricity needs by 80 per cent; Terragon Environmental Technologies, which is leading a project to develop an electrical wastewater treatment system for isolated communities; and Ostara Nutrient Recovery Technologies, which is developing technologies to recover nutrients from liquid sewage and convert this to safe fertilizers.

SDTC is also funding 39 technology projects that have a secondary benefit for water with \$103.4 million in funding for projects with a total value of \$365.6 million. Examples include Highmark Renewables, which is demonstrating an anaerobic digestion system that utilizes cattle manure to produce energy, bio-based fertilizer and reusable water in large cattle feedlots; Vive Crop Protection, which is using nanotechnology to produce agricultural chemicals that have reduced spray water use rates and lower contaminants in soil and water run-offs; and N-Solv Corp., which is developing an in situ oil sands technology to significantly reduce water use.

3: Crafting a strategy for Canadian success

Experience shows that sector strategies, with long-term goals, can work. The 1965 Canada-United States Automotive Pact and all the federal and Ontario policies that followed built an automotive industry in Canada. Similarly, Canada has been successful in developing an aerospace industry through a sector strategy. Now it is trying to build an oil sands industry. Sector strategies make sense and can work. Water is our next opportunity. But key questions need to be answered.

First

How do we build a national water opportunities strategy to mobilize our capabilities?

- The federal government should become a much more active partner with industry, academia and other levels of government, in designing a national water opportunities strategy that is focused on identifying and supporting Canadian activities that are relevant to and address Canada's own requirements, but which have potential for the global water market.
- Alternatively, we could build a national vision from the bottom up, forming a "CanAqua" Alliance/Partnership of provinces, municipalities, key water users, research institutes in academia, and non-profits, that would enable and attract engagement from the federal government as well.
- The Council of the Federation Water Charter, using the European Water Directive as a model, could design a Canadian strategy.
- Industry leadership is critical. There is an urgent need for the water industry to establish a Canadian identity. A strong association is needed to speak to Canadians about opportunities and challenges.
- Leading water users are an important part of the dialogue and need to be engaged in building a water alliance/partnership in Canada.
- We need to better understand the space with a "net map" that shows the broadly defined water sector – not only governments, research institutes, companies, granting councils, venture capital and water-related non-profits, but also users, service providers (law, accounting, management consulting and other business and professional services), land-use planners, technical suppliers to the water community, such as geophysical satellite services and software used for ecosystem and other forms of water management.
- Create a Water Opportunity Council, with strong participation by business, academia, non-profits, water-linked organizations and all three levels of government as an advisory body to help set goals, propose policies and provide advice and feedback.
- Given the lack of data on Canada's relative strengths and weaknesses in water research, skills and technology, develop the metrics necessary to help focus on where Canada can build on its strengths and where it has important gaps to fill.

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Sector strategies make sense and can work. Water is our next opportunity. But key questions need to be answered.

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- Develop better understanding by Canadians of the true nature of our water situation, including its regional dimensions, so that the public has a better understanding of the challenges we face, as well as the opportunities, with a view to a better appreciation of the costs of ensuring safe and adequate water, and changing behaviour.
- Focus on consistent monitoring of Canada's water availability and use for evidence-based policy and regulatory decisions, including those affecting human health. Information should be available to all Canadians on a regular basis, with full transparency and accountability. Canada lacks such information today. This includes accelerating the mapping of Canada's groundwater assets.

Second

How do we build global strengths by addressing our domestic needs for sustainable water management?

- Recognize that in designing a national water opportunities strategy that the focus should be broad enough to expand the areas of opportunity. Building codes, for example, could require significant water efficiency and the use of rainwater, and development of drought-resistant crops suitable to the Canadian prairies and other water-challenged areas of Canada.
- Ensure that regulatory requirements are high enough, and inspection/enforcement/compliance regimes are timely and effective, to stretch industry to develop new technologies and systems. This means developing a network of regulators and procurers who recognize the importance of new technologies and want to make Canada a country where the regulatory framework actively encourages innovative solutions. A strong regulatory environment is a key factor in driving innovation since it creates competition and a market for entrepreneurs to advance new ideas and solutions.
- Price water so that it accurately reflects true costs. This should lead to a greater demand for water conservation technologies. A tiered pricing system, which ensures all households a lower price for a minimum amount of water deemed necessary for basic needs, followed by an escalating price schedule as use increases beyond that.

Third

How do we focus leading-edge research for results, and build our research strengths?

- In co-operation with industry, academia and provincial and municipal governments, government could develop a technology road map for the water industry, broadly defined, to help define and drive research needs and business opportunities.
- Ensure significant support and incentives for public and private-sector research and development.

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- Support fundamental and applied science in our universities and research laboratories to expand the knowledge base and develop the new ideas that can be commercialized and developed in existing enterprises or through the creation of new companies.
 - Ensure adequate funding of federal research, especially at the frontiers of knowledge that may not be suited to academic or industry, such as the long-term monitoring of water.

Fourth

How do we grow Canadian companies so they can contribute to global solutions?

- Consider a requirement or target in federally or provincially-funded water and wastewater infrastructure that encourages contractors to demonstrate the use of emerging Canadian water technologies. Domestic content is a standard requirement in military procurement.
- Since risk-aversion is often a reason that municipalities and companies are unwilling to be early adopters of a new system or technology, Canada could devise some kind of “seal of approval” that would reassure would-be purchasers about the performance of new systems or technologies.
- Build a market for innovation, for example, through the proposed federal long-term infrastructure plan targeted for 2014 and beyond. Government as first customer is critical in many new technologies and funding for demonstration projects is important. There is an urgent need to pursue strategic procurement that includes early adoption of Canadian innovations.
- Pursue links between the water-food-energy nexus to identify innovation and market opportunities, with users as key participants. Working closely with business and the academic community, the National Research Council could host this, with support from Industry Canada, Agriculture and Agri-Food Canada, Natural Resources Canada, Environment Canada and other government departments, as well as provincial governments and academia.
- Major users – in mining, oil and gas, food processing, chemicals and other sectors – could be a source of venture capital for emerging water companies, as well as serving as a critical first customer.

Fifth

How do we help Canadian entrepreneurs fund and commercialize new technologies?

- Improve opportunities for commercialization while recognizing that the focus must go beyond encouraging start-ups, which is the easiest part of commercialization. The goal must be to scale-up companies through the so-called Valley of Death so that they have the size and cash-flow necessary for ongoing innovation and growth in the marketplace.

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- Consider the establishment of a Green Bank, as the British have done, to finance water projects. In addition, public-private partnerships can also help finance water infrastructure projects. Likewise, the Federation of Canadian Municipalities' Green Municipal Fund is another model to advance Canadian capabilities. Advancing Canadian capabilities should be a part of their mandates.
 - Expand support programmes for high-risk innovation projects that are business-led; Sustainable Development Technology Canada and the Industrial Research Assistance Programme are proven programmes with well-established track records. Provincial programmes are also important.

Sixth

How can we develop our skill sets, from researchers and managers to operators and entrepreneurs?

- In consultation with industry, develop an outline of future skills requirements so that apprenticeship systems, colleges and universities can ensure that the requisite courses and programmes are in place.
- Make Canadian universities, colleges and water institutes internationally recognized training centres for researchers and water managers to technical skills and water system operators.

Seventh

How should we make greater use of pricing and other market mechanisms?

- Effectively price water so that incentives are in place to encourage efficient use of water. Create a market for new technologies and generate revenues to finance infrastructure maintenance and development.
- Move to truly full-cost accounting for municipal water systems, with the possibility of a tiered or appropriately structured pricing system so that price increases with the volume used. Low-income families would have affordable access for essential water needs, while heavy water household water users would pay more.



Eighth

How do we better connect with global partners?

- Make clean water a priority for the Canadian International Development Agency, and seek ways to connect Canadian expertise to international projects funded by the World Bank Group, the Asian Development Bank, the Inter-American Development Bank, the European Bank for Reconstruction and Development, and the African Development Bank.
- Ensure adequate funding to ISTPCanada to engage in shared research and commercialization projects with researchers and businesses in China, India, Brazil, Israel and elsewhere.
- Mandate Export Development Canada (EDC) to become a centre of market intelligence for opportunities outside of Canada, as well as expanding its capacity to help Canadian water companies expand in world markets. In 2012, EDC and Sustainable Development Technology Canada joined forces to promote the role of Canadian cleantech companies in international markets.
- Sustain the CIDA programme which allows the Federation of Canadian Municipalities to send knowledgeable experts from Canadian municipalities to provide advice and know-how municipalities in the developing world.
- Examine cross-border opportunities for cross-border co-operation. The Ontario/Québec-Great Lakes region, the Fraser River Basin in B.C.-Washington and Oregon, Manitoba-North Dakota and Saskatchewan-North Dakota/Montana are examples where a shared interest is clear on water supply, water quality, flooding and eutrophication.

Ninth

How can we use our water supply and water management to attract foreign investors?

- Promote Canada as an investment destination for companies that need reliable supplies of sustainably managed, clean water.
- Brand Canada as a tourist destination that offers an outdoors experience that includes healthy freshwater lakes and rivers.
- Make Canada a centre for demonstration of radical new technologies and a place where water entrepreneurship and research are flourishing. Leading-edge activity attracts companies that want to be close to world-class innovation.

4: Conclusion

Next steps are vital.

We know the world must act to resolve increasing water shortages and ensure clean water for a growing population, feed an expanding world and meet escalating resource and energy demands at a time when incomes are rising and consumption demands are growing – all the while with climate change threatening to disrupt the availability and distribution of water.

Canada has the potential to be one of the countries delivering water solutions to the world. But will we seize the opportunity?

The biggest challenge will be to identify the water champions – the individuals in the public and private sectors who can provide the necessary leadership and make the sustained commitment to drive a successful strategy for Canada as a water solutions country. These champions will not only have vision, but also the determination to move from aspiration to implementation. Forming a nationwide alliance of the water community – water users, academia, water companies and non-profits, as well as governments at all three levels, as part of a CanAqua Alliance/Partnership, will deliver a credible and robust base from which to build Canada's capacities as a water solutions country.

However, the sustained leadership that champions can provide, from the private sector as much as the public sector, is critical if such a possibility is to be turned into a reality. Water will be the great global challenge of the 21st century, and the world will expect Canada, as the steward of one of the greatest freshwater supplies on our planet, to help turn an impending crisis into a sustainable solution. Addressing the world's need is Canada's opportunity – but it is up to Canadians themselves to take the lead.



Appendix: Canadian Companies

The fact that we have a base of Canadian companies already engaged in the global marketplace with proprietary technologies, shows that we have the capacity to be a water solutions country. Many are niche players and are high-value partners in global value chains. The list below illustrates the range and diversity of some of Canada's technology-based water companies:

- **Advanced Water Technologies Inc.** of Lethbridge, Alberta specializes in lake and pond restoration and water treatments for municipalities, golf courses and resorts with a product designed to digest organic build-up and remove soluble organic compounds. The company works closely with Lethbridge College.
- **Anaergia Inc.** of Burlington, Ontario is a company serving global markets in the production of clean energy from organic waste streams with anaerobic digestion technologies for municipal, industrial, commercial and agricultural markets. The company has made a number of acquisitions, including UTS Biogas Europe in Germany, Pharmer Engineering in the United States, and The Stover Group in Britain.
- **Aqua-Pure Ventures (TSX-Venture AQE)** of Calgary has developed technology to recycle industrial wastewater, with the oil industry as a major market. Fountain Quail Water Management of Fort Worth, Texas is its oilfield-services subsidiary.
- **Associated Engineering** of Toronto is a diversified engineering company that is active in water resource management, water supply and treatment and wastewater management. Its Saskatoon subsidiary, ATAP Infrastructure Management Ltd. provides technical, operating and training expertise in the operation and maintenance of water and wastewater systems.
- **A.U.G. Signals** of Toronto has developed water monitoring systems to improve the detection of contaminants and leaks in municipal water systems.
- **Bionest** of Grand-Mère, Québec designs and produces wastewater management systems and operates in global markets. It is a solutions provider dealing with contamination of water basins and groundwater and the misuse of treated water. It has more than 18,000 systems installed worldwide and is active in the United States, the Caribbean, the Middle East and Europe.
- **BioteQ Environmental Technologies (TSX BQE)** of Vancouver is a water treatment company providing technologies for wastewater treatment in the mining, energy and manufacturing industries, with sales in Canada, the United States, Mexico, Australia and China.
- **CH2M Hill** of Toronto is a major water and wastewater engineering company, operating in Canada as a subsidiary of its parent company in the United States.
- **Echologics Engineering** of Toronto designs and commercializes leak-detection technologies to reduce water losses in municipal water distribution systems. Its technologies are sold in North America and many other parts of the world.
- **Eco-Tec** of Pickering, Ontario is a water and wastewater company that designs and builds process equipment used in water treatment and other processes. The company works through partnerships

with engineering firms to provide technology for large-scale plants, primarily in the United States. It has supplied technology for more than 60 countries.

- **Eco Waste Solutions** of Burlington, Ontario custom engineers and manufactures advanced thermal treatment technologies for solid and liquid waste for small communities, military operations and resource-industry camps, typically in remote locations.
- **ENBALA Power Networks** of Toronto uses electronic networks to monitor water systems and enable a reduction in the energy costs arising from water management.
- **ENDETEC (formerly Pathogen Detection Systems)** of Kingston, Ontario has been acquired by Veolia Water Solutions and Technologies Canada, a major French-owned water company, to be its global headquarters for water-sensing technology to detect potentially harmful pathogens, including bacteria and chemicals, and provide continuous in-pipe monitoring of pollutants and contamination.
- **EnvirEau Technologies** of Richmond, B.C. is a global leader in developing ionized natural minerals to control bacteria, fungus and algae in water, wastewater, and food, and for disease control in crops, with the goal of replacing synthetic chemicals and disinfectants in these applications.
- **EPCOR** of Edmonton is a company owned by the City of Edmonton that builds and operates water, wastewater and distribution systems for municipalities and industry in Canada and the United States through its subsidiary EPCOR Water Services Inc. It is the largest private water provider in New Mexico and Arizona. It currently owns or operates more than 50 facilities.
- **Evandtec Inc.** of Toronto designs water tower cooling systems for water and energy efficiency in commercial, institutional and industrial facilities around the world, reducing water needs for cooling by up to 50 per cent. The company is also developing web-based software for water systems.
- **FilterBoxx Water and Environmental Corp.** of Calgary designs and builds engineered water and wastewater treatment systems for the oil and gas industry and other remote site locations. Its market potential includes remote natural resource projects, First Nations, small communities, and resorts. It has systems in place for the oil and gas and mining industries in Canada, the United States and Afghanistan.
- **GE Water and Process Technologies** of Oakville, Ontario, is a leading manufacturer of membrane technologies for water and wastewater treatment that are sold around the world. The former Zenon Technologies was acquired by GE in 2006 for \$656 million.
- **Golder Associates** of Toronto is an employee-owned water engineering and consulting company focused on contaminated soil and groundwater remediation. It operates in many parts of the world, not only the United States, but Australia, Britain, Kazakhstan, Ghana and Hong Kong, for example.
- **Ground Effects Environmental Services** of Regina, Saskatchewan provides mobile water remediation services for a range of industries including mining and oil and gas. It claims to be one of the largest environmental remediation companies in North America.
- **H2O Innovation (TSX-V HEO)** of Québec City has developed advanced membrane technologies for the production of drinking water and treatment of wastewater and for use in municipal, industrial,

commercial, mining and energy markets. It supplies domestic and international markets. The company has a United States subsidiary formed from several acquisitions, and a joint venture in India.

- **Hatch Engineering** of Mississauga, Ontario, has expertise and international presence based on strengths in water resource management, water and wastewater treatment, water supply, desalination plants, river and coastal engineering and tailings management.
- **IET-Aquaresearch** of North Hatley, Québec has developed a microbial technology called Bacta-Pur to improve water quality by safely biodegrading pollutants in wastewater, lakes, rivers and ponds. Its system is sold in Europe and Asia.
- **Ivey International** of Campbell River, B.C. specializes in remediation technologies to restore water quality with proprietary technologies.
- **newterra Ltd.** of Brockville, Ontario designs, engineers and builds membrane bioreactor technology systems, treating sewage to near-potable quality in systems around the world. The systems can be used in mining, forestry, oil and gas and food and beverage industries, small municipalities, subdivisions lacking access to major sewage networks, hotels, resorts, slaughter houses, agriculture polluted wastewater, and industrial chemical plants. The company has production facilities in the United States and Germany, as well as Brockville.
- **Ostara Nutrient Recovery Technologies** of Vancouver recovers potentially harmful but valuable nutrients such as nitrogen and phosphorous from municipal and industrial water systems and converts them into slow-release fertilizer marketed as Crystal Green. Its technology was licensed from UBC. It opened its first commercial plant in Edmonton in 2007.
- **Paradigm Environmental Technologies** of Vancouver has developed proprietary technology to process biological sludge at municipal water treatment plants and industrial facilities that enhances the rate and efficiency of the anaerobic digestive process thereby lowering costs and expanding plant capacity.
- **Premier Tech Aqua Ltd.** of Rivière-du-Loup, Québec is active in international markets with proprietary technologies for onsite and decentralized wastewater treatment in residential, commercial, municipal and industrial markets. In 2010 the company acquired its French partner, now known as Premier Tech Aqua Purflo.
- **ProSep Inc. (TSX PRP)** of Montreal has developed proprietary membrane ultra-filtration system technology to separate oil and gas, sulphates and mercury from water used in oil and gas production. The company's technology is used in different parts of the world, including the Gulf of Mexico and Australia. ProSep holds a majority interest in a Korean joint venture, ProSep Kolon Co.
- **Pure Technologies** of Calgary is a world leader in technologies for the inspection, monitoring and management of water and wastewater pipelines, with proprietary technology. It is active in global markets, focusing on detection of leaks in pipelines, to significantly reduce non-revenue water (water lost to leakage) through improved asset management.
- **Real Tech Inc.** of Whitby, Ontario has sold proprietary technology in 35 countries, including ultraviolet and spectroscopic analytical instruments for the water and wastewater industries.

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- **Saltwork Technologies Inc.** of Vancouver has developed desalination technologies and industrial water treatment systems. It has won contracts from the Canadian navy, an Australian energy company, an Alberta oil and gas producer and the National Aeronautics and Space Administration (NASA). The NASA project is to test its technology for future use in water recovery from the International Space Station.
 - **Sanexen Environmental Services** of Varennes, Québec is engaged in the structural rehabilitation of water mains and the remediation of contaminated sites in projects across North America.
 - **SiREM** of Guelph, Ontario, uses biological technologies to support groundwater remediation from chlorinated solvents and other recalcitrant chemicals.
 - **Soane Energy** of Calgary has developed technologies that can improve oil sands process efficiency while cleaning up tailings effluent and remediating existing tailings ponds.
 - **Stantec (TSX STN)** of Edmonton is a leading international engineering firm whose expertise includes wastewater management, water treatment, water supply and water resource management. Its market capitalization at the end of 2012 was \$1.8 billion.
 - **Tantalus Systems Corp.** of Burnaby, B.C. develops and manufactures two-way data communications networks for Smart Grid applications, including water utilities. The information can be used for leak detection, monitoring of use and other reports.
 - **Terragon Environmental Technologies** of Montreal has developed small-scale technologies for wastewater treatment that can be used effectively in special markets, including resorts and hotels, remote communities and habitats, and the military, including naval vessels.
 - **Trojan UV** of London, Ontario, is a world leader in ultraviolet technologies for clean water. One of Canada's first and most successful water technology leaders, it was acquired for \$247 million in 2004 by Danahar, a United States corporation. In 2008 Trojan acquired R-Can Environmental of Guelph, Ontario, a manufacturer of ultraviolet systems for residential use. It integrated its residential business into the Guelph operation and renamed it Viqua.
 - **UV Pure Technologies** of Toronto manufactures UV water purification technologies for residential, commercial, industrial and municipal treatment of wastewater, reuse water, rainwater and drinking water. Its systems are in use in countries around the world and its customer base includes GE, Siemens, 3M Corp. as well as engineering firms such as Veolia, CH2M Hill and Eco-Tec. Its technology is employed in the new Boeing 787 Dreamliner for water purification.
 - **Veolia Water Canada** of Mississauga, Ontario is a subsidiary of the French water company, Veolia, one of the largest water companies in the world. Directly and through Veolia Water Solutions and Technologies, and its two Canadian subsidiaries, John Meunier Inc. and ENDETEC, it provides a range of water and wastewater services to municipalities and industry.
 - **Xogen Technologies** of Orangeville, Ontario has developed a new electro-chemical wastewater treatment technology that employs up to 75 per cent less space than conventional treatment facilities. It employs an electrolytic process that also produces a mixture of hydrogen, oxygen and nitrogen gas, which can be used to generate electricity.

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Our Partners:



CANADIAN WATER NETWORK
RÉSEAU CANADIEN DE L'EAU

At the Canadian Water Network (CWN), success happens when the right people and leading knowledge are combined to identify the possible and achieve shared goals for water management in Canada. CWN convenes government, industry and non-governmental partners around core challenges and connects them with leading knowledge in a way that addresses the practical realities of water management. It ensures that research is actionable and leads to solutions.



The RBC Blue Water Project is an historic, wide-ranging, 10-year global commitment to help protect the world's most precious natural resource: fresh water. Since 2007, RBC has pledged over \$36 million to more than 500 charitable organizations worldwide that protect watersheds and promote access to clean drinking water, with an additional \$6 million pledged to universities for water programs. In 2013-2014, the RBC Blue Water Project will focus on supporting initiatives that help protect and preserve water in towns, cities and urbanized areas.



The Walter and Duncan Gordon Foundation is a private, philanthropic foundation based in Toronto, Canada. The Foundation undertakes research, leadership development and public dialogue so that public policies in Canada reflect a commitment to collaborative stewardship of freshwater resources and to a people-driven, equitable and evolving North. Their vision and mission is to promote both at home and abroad innovative public policies for the North and in fresh water management based on values of independent thought, protecting the environment, and full participation of indigenous people in the decisions that affect their well-being.

