BLUE ECONOMY INITIATIVE

Blue City: The Water Sustainable City of the Near Future

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

Prepared by Econics

JANUARY 2014

Table of Contents

List of Case Studies

Introductory Letter

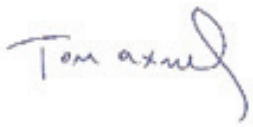
Canada faces an estimated cost of $88 billion water and wastewater infrastructure deficit and this estimate is expected to grow under a "business as usual" approach. There is a growing understanding that the 20th Century approach to water infrastructure is inefficient, costly, and largely inadequate. Canadian communities must adopt a new vision that includes a large portfolio of innovative solutions alongside innovative funding mechanisms. The vision for such communities, to co-exist with water in an environmentally and financially sustainable model, is closer than we think.

This fourth report from the Blue Economy Initiative and its partners looks to the future. The previous three reports have dealt with critical analysis, insights and recommendations on the value of water as a financial asset and a catalyst for innovation in Canada. In this piece, 17 water-related professionals in Canada were asked what their vision of a Water Sustainable City of the near future would look like.

This report showcases the inspiring and practical foresight of the interviewees. It goes further though to illustrate tangible examples of water-sustainable projects in municipalities and regions across the country. The authors, after interviewing the 17 professionals, pointedly show the need for greater cooperation between all levels of government, successful leadership to drive innovation and change, and the need to truly celebrate water as a fundamental part of urban living.

On behalf of BEI's founding members, I invite policy-makers, government officials from all levels, urban planners, businesses, community-leaders and citizens to read and disseminate this report. It is a vision of what could be if water truly mattered to us all.

Sincerely,



Thomas S. Axworthy
Chair of the Blue Economy Initiative

Preface

The Blue Economy Initiative (BEI) is a national project founded by 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.

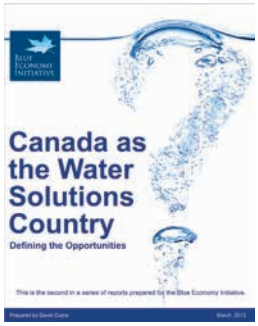
By producing discussion papers and convening events, we intend to catalyze discussion and action that will strengthen our national understanding of the value of water, create broader awareness of the risks of failing to make sustainable decisions, and illustrate the opportunities and benefits of sustainable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

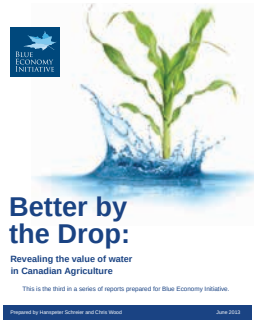
Three feature reports have been prepared to date as part of a four-part series developed on behalf of BEI. These include:

1. A report by Steven Renzetti, Diane Dupont, and Chris Wood entitled *"Running Through Our Fingers"* looked at Canada's ability to adequately measure and account for the value that water contributes to our economy.

2. A paper by David Crane entitled *"Canada as the Water Solutions Country: Defining the Opportunities"* helped frame a national conversation around Canada's water-related strengths as well as emerging opportunities to become a global leader in water sustainability and innovation.

3. A report by Hanspeter Schreier and Chris Wood entitled *"Better by the Drop: Revealing the Value of Water in Canadian Agriculture"* analyzed the critical juncture between water and agriculture in Canada and the opportunities to increase agricultural output with such tools as virtual water and water footprint analysis.





This fourth report in the series is a look, into the near future, at an unknown City where the main focus is subject to one critical question: *What would the City of the near future look like if water really mattered?* After interviewing 17 well-respected Canadian professionals on the topic of sustainable water and cities, the authors were able to weave together a fascinating and compelling report on a vision for a Water-Sustainable City.

The report has three major sections:

- **A Sketch of the Water Sustainable City** envisions the physical, social, and cultural features of the City.
- **Digging Deeper: Exemplary Elements of the Water Sustainable City** describes areas for action that will move current cities towards sustainability.
- **Pitching Change: Making the Business Case** frames strategic considerations around building the business case for the actions described in the second section.

This is very much a visionary piece yet its foundation is grounded in research, design, and innovation. The Water-Sustainable City of the Future is not far off and there is a strong vision now about what it looks like and most importantly, how to get there.

Acknowledgements

The Blue Economy Initiative would like to acknowledge and thank Kirk Stinchcombe and Louise Brennan at Econics for their own innovative research and work on this report on behalf of Blue Economy Initiative. We are also grateful to Korice Moir, Tim Morris, and Michelle McCulloch for their significant contributions to this piece. This particular report stands out as a visionary piece and moves beyond traditional reports and papers.

We would like to extend sincere appreciation to the following individuals for providing feedback, content and suggested improvements. These include Shari Austin, Tom Axworthy, Carolyn Dubois, Bernadette Conant, Simon Glauser, Sandra Odendahl, Lynn Patterson and Jenn Willoughby.

The authors extend their gratitude to the thought leaders and experts who made this report possible. We thank them for generously sharing their insights, time, and editorial assistance: Jean-François Barsoum, Carl Bodimeade, Oliver M. Brandes, Dr. David B. Brooks, Greg P. Chartier, Glen T. Daigger, Mary Ann Dickinson, Lou Di Gironimo, Mike Hausser, Andrew Hellebust, David Henderson, Bryan W. Karney, Theresa McClenaghan, Scott Murdoch, Cate Soroczan, Kim Stephens, and Carl D. Yates.

We also thank the staff from the organizations profiled in the report's case studies. They enthusiastically supported this project by providing content and images for their respective locations. In particular, gratitude is extended again to Scott Murdoch (Murdoch de Greef Inc.) and Carl D. Yates (Halifax Water), as well as to Sophie Martinez (City of Chicago), Aprella Johnson (City of Chicago), Chris Cooper (EPCOR Utilities Inc.), Stephanie Begin (EPCOR Utilities Inc.), Regina Carpenter (Seattle Public Utilities), Craig Omoto (Seattle Public Utilities), James Campbell (Halifax Water), Julie Anne Lamberts (City of Guelph), Wayne Galliher (City of Guelph), Mark Goody (Town of Okotoks), and Kim Evans (City of the Gold Coast).

Authors

Research and analysis for this project was completed by Victoria, BC-based Econics. Econics are sustainability specialists dedicated to making water, and the systems that deliver it to people, last sustainably. They work with local governments, water utilities, and other organizations, and provide services under three core themes: lasting supply, lasting revenue and lasting community support. For more information see www.econics.com

Kirk Stinchcombe
Sustainability Specialist

Louise Brennan
Sustainability Specialist

econics

Report design was led by Bravo Advertising. Also based in Victoria, Bravo is a small firm that is big on service, with areas of specialty that include presentation material design, identity packages, advertisement campaigns, art direction and copywriting. For more information see www.bravoadvertising.ca

Lorianne Koch
Creative Director

bravoadvertising

Cast of Interviewees

Full biographies of the interviewees can be found in Appendix B.

Jean-François Barsoum
Senior Managing Consultant, IBM

Theresa McClenaghan
Executive Director & Counsel,
Canadian Environmental Law Assoc.

Lou Di Gironimo
General Manager, Toronto Water

Oliver M. Brandes
Co-Director & Sr. Research Officer,
POLIS Project

Dr. David B. Brooks
Water Advisor, Independent

Kim Stephens
Executive Director, Partnership
for Water Sustainability in BC

David Henderson
Founder & Managing Director,
XPV Capital Corporation

Glen T. Daigger
Sr. Vice President &
Chief Technology Officer, CH2M HILL

Mary Ann Dickinson
President & CEO,
Alliance for Water Efficiency

Carl Bodimeade
Senior Vice President,
Hatch Mott MacDonald

Scott Murdoch
Principal & Landscape Architect,
Murdoch de Greef Inc.

Mike Hausser
Director of Asset Management,
City of Cambridge

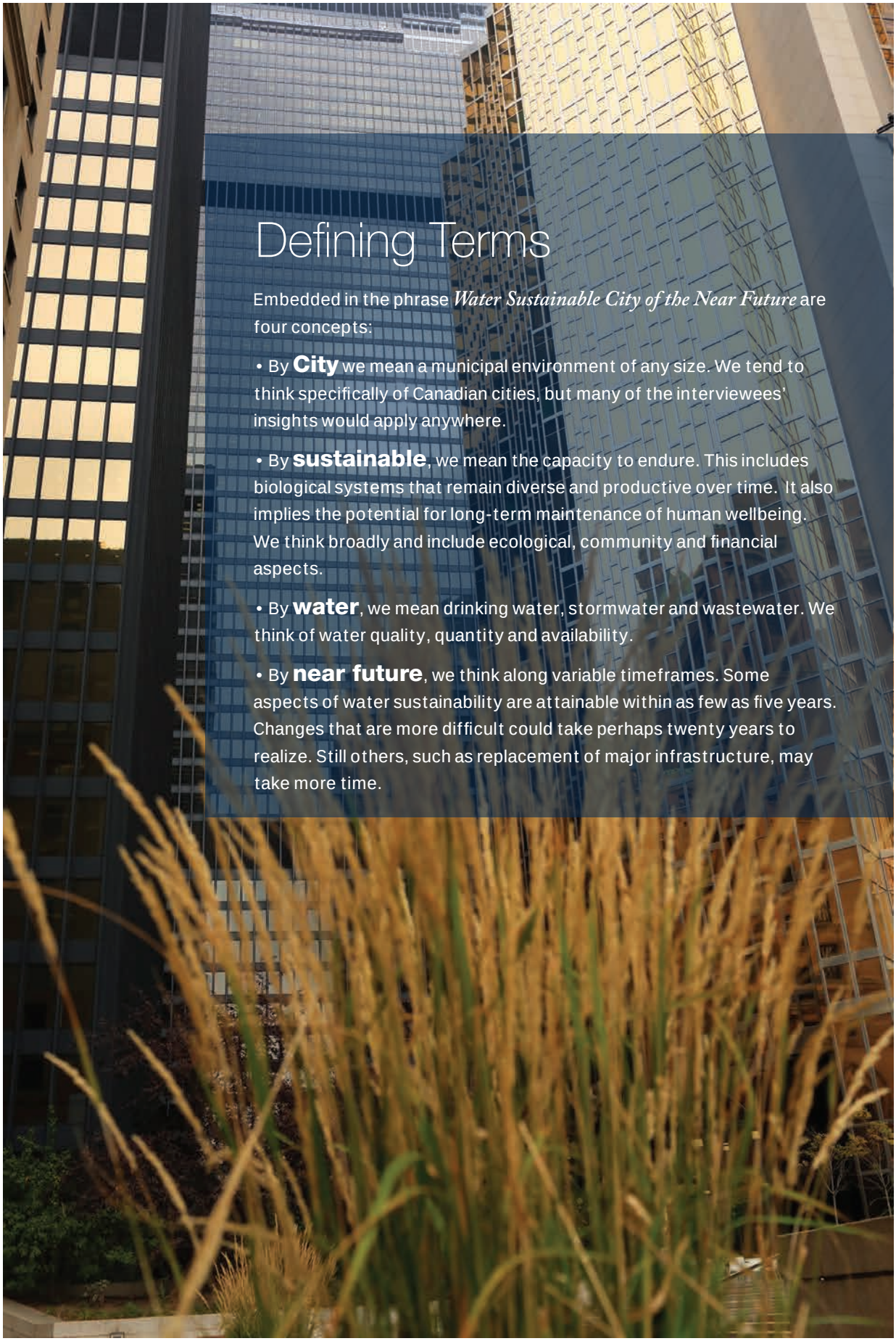
Andrew Hellebust
President, Rivercourt Engineering

Greg P. Chartier
Asset Management Consultant,
Independent

Carl D. Yates
General Manager, Halifax Water

Bryan W. Karney
Associate. Dean, Engineering,
University of Toronto; Principal,
HydraTek & Associates Inc.

Cate Soroczan
Senior Researcher, Canada Mortgage
and Housing Corporation



Defining Terms

Embedded in the phrase *Water Sustainable City of the Near Future* are four concepts:

• By **City** we mean a municipal environment of any size. We tend to think specifically of Canadian cities, but many of the interviewees' insights would apply anywhere.

• By **sustainable**, we mean the capacity to endure. This includes biological systems that remain diverse and productive over time. It also implies the potential for long-term maintenance of human wellbeing. We think broadly and include ecological, community and financial aspects.

• By **water**, we mean drinking water, stormwater and wastewater. We think of water quality, quantity and availability.

• By **near future**, we think along variable timeframes. Some aspects of water sustainability are attainable within as few as five years. Changes that are more difficult could take perhaps twenty years to realize. Still others, such as replacement of major infrastructure, may take more time.

Executive Summary

This is a story about what is possible in urban water sustainability. *The Water Sustainable City of the Near Future (the City)* is an idea that is emerging and well within reach for most communities. It is not a utopian fantasy. The elements that make the City exemplary are occurring in real places across Canada and around the world. The City described herein combines these characteristics into a single, fictional location, and in so doing demonstrates an end state towards which real cities can aspire. It is what any place could look like if water really mattered.

This report is intended to help practitioners and decision makers build a business case for advanced and integrated water management. The content is based on interviews with 17 subject matter experts and thought leaders. Together, they defined a common vision, shared innovations in their unique and diverse disciplines, and suggested cross-cutting business case considerations. These three themes form the core sections of this report.

A Vision of the Water Sustainable City

Since the City is an amalgamation of various aspects of real cities, it is easy to imagine its physical attributes, social relationships and cultural norms. Three components frame this vision:

- **Water is visible and valued.**
  This is accomplished by incorporating green design into development. Water is also valued, which is demonstrated by the community's conservation ethic.
- **A culture of conservation exists.**
  The conservation ethic found with respect to water extends to energy and all natural resources. Citizens appreciate that cities are embedded in natural systems.
- **Responsibility is shared.**
  Planning and decision-making are complex processes. Sustainability is achieved through integration and cooperation. Citizens are engaged and involved. They create their own city.

Digging Deeper: Essential Innovations in the Water Sustainable City

Based on innovations in their fields, the interviewees identified four broad areas where tangible progress towards sustainability could be made.

Financial Responsibility:

- Sustainable utilities focus on levels of service, develop asset management plans, and embrace life cycle costing.
- Utilities develop new ways of financing capital investments that consider the long timeframe for returns and intergenerational equity.
- In pricing services, utilities aim for full cost recovery and structure their rates to influence behaviours.

Progressive Regulation and Governance:

- Progressive regulations and incentive-based programs complement each other in driving performance and ultimately achieving water sustainability goals.
- Performance-based regulation focuses everyone on the end goal. It effectively separates oversight from implementation, creates opportunity for flexibility and innovative solutions, and maintains accountability.
- A well-designed utility governance structure facilitates information flow and achieves resource efficiencies. An independent regulatory body may enhance transparency and accountability to the public.

Customer-Oriented Information:

- Service providers give customers personalized feedback on their water use and behaviours, similar to information provided by mobile phone companies, Internet providers and energy utilities.
- Utilities measure their performance. This facilitates transparent reporting and informs planning processes.
- In a sustainable city, information is shared, integrated, and audience-specific.

Cutting-Edge Technology:

- New utility configurations are formulated around innovative service models for drinking water, wastewater, and stormwater.
- Transformative utilities figure out how to incorporate technology that makes source separation economically viable.
- Sustainable cities have infrastructure that maintains the natural environment and minimizes the impact of activities on native ecosystems.

Pitching Change: Making the Business Case

To attain these outcomes and innovations, an argument for creating change must be made. Although each business case inevitably will be unique, there are several cross-cutting considerations.

- A successful business case is framed around the pain points the City is facing.
- Each case clearly identifies the value created for customers and the City.
- Long-term financial models are necessary for sustainable solutions.
- The right choice is not only economically and environmentally logical, it also considers public opinion and political preference.

Creating processes that are inclusive of the diversity of opinions around water management is arguably the most challenging part of building a water sustainable city. Our experts remind us that success will require effective change management, including dedicated leadership, managing risk, and celebrating achievements.

With a shared vision, taking small, frequent steps towards creating the *Water Sustainable City of the Near Future* is possible. Together, we can navigate diversity and complexity, and ultimately move a real city towards more sustainable practices. The time to plan, to innovate and act is now.

A.

Introduction

This is a story about what is possible in urban water sustainability. It endeavours to inspire vision, suggest action, and help practitioners frame a business case for pursuing water sustainability. The research that supported this report was oriented around one central question:

What would the City of the near future look like if water really mattered?

This inherently frames the challenges and opportunities of the City through the lens of water. Of course, the water politics of the City will be a subset of much broader and complex politics. Water management within the City is only one aspect of ecological management on the landscape and water is but one component of ecosystems. However, given the vast number of connections between natural and human systems, the scope of this project is limited to the management of drinking water, wastewater and stormwater in urban contexts.

Seventeen people were interviewed individually to provide the substance of this story. As the interviews progressed, many of the ideas overlapped to create an intricate and inter-connected picture. It was easy to imagine one conversation – 17 people sitting around a table, brainstorming and debating about the City of the near future. (Appendix A provides more detail on the project and methodology. Appendix B provides short biographies of the interviewees.)

It became clear that the City is a location these people can easily visualize and describe – somewhere they can travel to in their minds, not too different from their own cities. We use the term "City" throughout as a proper noun to remind ourselves that this is a practical and attainable place – a place we might hope to live sometime in the not-too-distant future.

Following the threads of our experts' conversation, the report has three major sections:

A Sketch of the Water Sustainable City (Part B) envisions the physical, social, and cultural features of the City.

Digging Deeper: Exemplary Elements of the Water Sustainable City (Part C) describes areas for action that will move current cities towards sustainability.

Cross-Cutting Considerations for Pitching Change (Part D) frames strategic considerations around building the business case for the actions described in Part C.

B.

A Sketch of the City

The *Water Sustainable City of the Near Future* is an idea that is emerging and well within reach for most communities. It is not a utopian fantasy. The elements that make it exemplary are occurring in real places across the country and around the world. The City described herein combines these characteristics into a single, fictional location and in so doing demonstrates an end state towards which real cities can strive.

Since the City is an amalgamation of various aspects of real cities, it is easy to imagine its physical attributes, social relationships, and cultural norms. The difference being that in this place, water matters. Our experts have identified its defining characteristics, which together sketch a picture of what a water sustainable city may look, feel, and be like.

Water is Visible: Blue and Green Landscapes

In the City, water is visible and celebrated. People and businesses embrace 'living with water'. This means that watercourses are allowed to flow through the City, buildings are designed or retrofitted to accommodate natural processes, such as flooding, and the discharge of pollutants is minimized or avoided.

In particular, stormwater is considered a treatable, usable resource. It is captured – as rainwater or runoff – and substituted for traditional water sources in buildings. Impermeable surfaces are replaced with permeable ones so that precipitation can infiltrate into the ground. The Atrium building in the City of Victoria demonstrates this practice in its award-winning, ecologically-sensitive design (see Case Study 1).

Physical infrastructure is 'green' in the City. Its elements are inspired by natural processes that mimic services ecosystems provide. Rather than trying to capture and control nature, green infrastructure allows the City to contribute to a functioning watershed. It also allows citizens to rely on 'local' water sources, such as rainwater, instead of 'importing' it from the surrounding environment.

Green Building Design in Victoria Reduces Local Environmental Impact

The Atrium is a seven-storey, 204,000-square foot retail and office building at the edge of downtown Victoria, BC. Design of this space embraced dual challenges: to revitalize the neighbourhood and enrich the community, as well as bring the economics of high-rise office developments to a mid-rise green building. In targeting LEED Gold certification, the Atrium was designed to maximize water and energy conservation and improve discharge water quality.

MURDOCH DE GREEF INC PHOTO

Water innovations include the first street-level rain gardens in downtown Victoria. These envelop the Atrium on three sides, capturing and cleaning street run-off from a two-inch rain storm before it is discharged into the ocean. When it rains, the gardens have a six-inch deep pool that acts as a buffer during intense events and creates an ephemeral water feature.

The Atrium also has one of the city's first blackwater retention tanks that stores sanitary wastes during peak hours then offloads it to sewers at off-peak times to reduce pressure on public infrastructure. To further minimize environmental impacts, high-efficiency technology is installed throughout the building.

The mechanical system is comprised of a low-temperature hot water perimeter radiation system, air-to-water heat pumps, a heat recovery system for exhaust, and CO_2 sensors to control outside air volume. These innovations have resulted in a 55 per cent energy savings over a conventional office space. The building also has a large green roof and a small grove of olive trees in the public atrium.

This is a multi-award winning project with acclaimed stormwater innovations. Notably, the boulevard plantings help to manage pollution from the street and to slow and reduce runoff. They also calm traffic, create a green buffer between pedestrians and roadways, and reduce heat island effects. And, perhaps most importantly, they demonstrate leadership, spark conversations, and provide educational opportunities to interested residents.

Scott

"We need cities where natural processes are visible. Water is a really great thing to see around us. It's dynamic and changing. Living in a static urban environment is just boring."

Lou

"We currently try to get stormwater away from our buildings as fast as possible, which creates flooding and huge infrastructure demands. In the future, we will have better stormwater management practices. We see it in newer suburban communities already with features like stormwater ponds. In an urban area, we don't have that capability, so we need to do a better job of harvesting rainwater."

Glen

"We can't expect people to appreciate water unless they can actually see it and experience it. It aesthetically enriches the city, but it also keeps water in front of people so they understand and value it."

Culture of Conservation: Small Energy, Resource, Water and Land Use Footprints

The City is relatively compact. Urban sprawl is discouraged. This minimizes the size of water distribution and collection networks, provides an adequate population base to fund advanced infrastructure, and distributes the cost of services among many people. Zoning bylaws encourage sustainable development and reflect the fact that land and water use decisions are connected. Deliberations about growth consider regional water availability. In Canada, the Town of Okotoks is an exceptional example of a place that emphasizes a conservation ethic and evaluates the effects of development decisions on local resources (see Case Study 2).

Minimizing resource and energy use is an important component of the City's culture. For example, co-benefits of water conservation are identified, including energy savings, reduced greenhouse gases from treatment and distribution, resource and energy recovery, and saving the materials used in infrastructure. At the water utility, staff also strategize how to conserve, recover, and reuse nutrients and energy. The ultimate goal is to reach a point where services are energy neutral. Considerations include putting wind turbines on lands used for source protection and storage, and installing turbines in water mains to generate additional energy capacity. There may be trade-offs between water demand reduction and energy use, but with careful analysis these can be understood.

When thinking about water, citizens and industries use it wisely. 'New' sources come from conservation and efficiency ("soft paths"). There is also greater reliance on local sources, such as grey water and stormwater. All sources are put to best use, which means that water is not wasted and the quality is appropriate for the purpose. Recovery and reuse underpin building design, city planning and citizens' actions. The utility also does its part towards conservation[1] by prioritizing early loss detection and repair in its distribution networks.

Numerous Canadian municipalities are currently looking at ways to reduce water use. One innovative example is Blue Built Homes, a program in Guelph that provides comprehensive rebate packages and certification for new developments that meet specified criteria (see Case Study 3).

[1] By "conservation", we mean both "conservation" and "efficiency". We recognize that these are different, albeit related concepts, but for simplicity of writing have summarized them as "conservation". Where "efficiency" is used, it is generally for discussions of cost-effectiveness.

Mary Ann

"Current zoning practices are often a challenge for the North American landscape. They encourage cookie cutter development and sprawl and discourage innovation."

Glen

"It doesn't take much to reach a point where water services are energy neutral to energy positive. You can capture kinetic energy through mechanical processes, chemical energy from organic matter and latent heat energy."

David

"The best next source is conservation. Even when we finally finish the first batch of conservation activities, this will still be true."

Andrew

"Water is conserved scientifically. By saving water, we actually mean a number of other things: reducing the greenhouse gases used to supply water, reducing the materials used in infrastructure, maintaining a natural water regime in the watershed, and maximizing the working capacity of water in the watershed."

Carl

"It used to be Canada's dirty little secret that we had such huge wastage. Now I'd just call it dirty. It's not a secret anymore. A good utility takes responsibility for system loss. District Metering Areas, real time analysis, night time flows, and benchmarking things like the Infrastructure Leakage Index and use per capita are critical."

Okotoks' Bylaws and Programs Work Together to Push Conservation Requirements

Okotoks is a town of 24,511 (2011) located 18 km south of Calgary. It relies on the Sheep River aquifer for its water supply. Due to significant pressures on the resource, no new licences are being issued in the watershed. But Okotoks is a growing town: population expanded 46 per cent between 2002 and 2010. Despite this, water use only climbed by 15 per cent over the same period. Continued growth and prosperity has required a combination of bylaws, comprehensive conservation planning, and cutting-edge demand management programs.

In Okotoks, staff have designed an innovative relationship between bylaws and incentive programs to encourage continuous improvements in conservation. The Town's Indoor Water Fixtures Bylaw, which is updated from time to time to reference the most economically accessible appliances and fixtures, requires specific indoor conservation measures. It applies to all new building, retrofits, and renovations that require a plumbing permit, including single family, multi-family, commercial, industrial, and institutional projects. Requirements include high-efficiency toilets (<4.8L/flush) and faucets (<5.7L/minute), high-efficiency showerheads (<7.6L/minute), water conserving appliances (EnergyStar®), and insulated hot water pipes.

To supplement the bylaw, Okotoks also has a Water Conservation Density Bonus Program (WCDB), which began in 2005. Although it is currently suspended due to a recent bylaw revision that incorporated items previously included in the WCDB program, Okotoks is researching even more innovative and advanced conservation techniques and technologies to comprise an updated incentive package.

The program offers developers of residential subdivisions a 10 per cent density bonus in exchange for including a range of indoor and outdoor conservation features that are more advanced than those specified in the bylaws. A Water Conservation Restrictive Covenant that describes agreed upon items is attached to the title of each individual lot. This is a legal document negotiated between the Town and the developer that becomes binding on future property owners and passes with changes of ownership. It specifies that no building on a lot shall be constructed, altered, or repaired (including changes to plumbing, irrigation systems, or landscaping) in a way that does not comply with the Covenant. The goal is to achieve an average 20 per cent reduction in water use per lot compared with non-participating houses.

From 2005-2011, with the exception of two communities, every new subdivision registered for the program, totalling approximately 3,000 single family homes. Results indicate that homes with a Covenant are using approximately 18 per cent less indoor water than a control group of non-participating homes. In 2012, gross per capita use each day was 312 litres and residential use was 184 litres.

Local Certification Program Encourages Water Efficient Developments in Guelph

Guelph has a population of 142,900 (2012), making it one of the largest Canadian cities to rely solely on groundwater as its drinking source. To mitigate real and anticipated constraints on supply, in 2009 Guelph City Council approved the Guelph Water Conservation and Efficiency Strategy Update. Its two key goals are to reduce 2006 water production levels by 20 per cent by 2025 and to use less water per capita than any comparable Canadian city.

CITY OF GUELPH PHOTO

To meet these goals, Guelph developed a suite of innovative demand management programs, one of which is the Blue Built Home Water Efficiency Standards and Rebate Program. This is a city-administered certification program that provides rebates for new homes that meet an approved set of water efficient standards ranging from faucet aerators to rainwater harvesting systems. Program-recommended appliances are backed by the WaterSense® and ENERGY STAR® labels.

Depending on whether a bronze, silver, or gold standard is achieved, these homes can reduce water consumption by 24 to 54 per cent compared to a standard home built to the Ontario Building Code. This results in savings of up to $300 per year on water bills. Actual water savings for a home built to a bronze standard is 92 litres per day. Moreover, this program has the potential to significantly reduce resource consumption into the future, considering that 626 residential building permits were issued in 2011. To date, the program has 30 homes built to a Blue Built Home bronze standard, with 25 of these currently certified, and two additional homes certified to the silver standard.

As with any new initiative, challenges have been encountered. Primarily these relate to the affordability of a Blue Built Home, builder participation, program awareness, and brand recognition. Guelph is currently undertaking a review and is consulting with the local building community on proposed program revisions with the goal of enhancing participation. Under consideration are a revision of certification requirements and levels, including the incorporation of plumbing rough-in requirements for more advanced systems (e.g., hot water recirculation), and the addition of a platinum standard.

Guelph's suite of water conservation programs has resulted in a current average rate of consumption of 184 litres per capita per day (lcd), much lower than the provincial and national averages. Overall, the City's water use has declined by 17 lcd from 2007 to 2011. Another 17 lcd is required to meet the Water Conservation and Efficiency Strategy's goals.

Shared Responsibility: Citizens are Engaged and Involved

The City's administration embraces collaboration and encourages broad participation in decision-making and policy-making processes. Participation does not necessarily mean delegation of responsibilities, but respecting and integrating various forms of expertise at each point in a process.

At the foundation of planning is a shared philosophy of managing people and their activities within their natural environment, instead of attempting to manipulate nature. Citizens recognize that sustainability is largely about governance - people, institutions and rules. They also recognize the importance of water and their own stewardship responsibilities, and therefore are eager to be involved in planning processes. Non-government organizations and professional groups also take part, making key contributions through skill development and capacity building.

Employees of the City work together across professions and departments, and look for opportunities to connect with non-governmental institutions and other jurisdictions. This is not easy, as business processes and hierarchies are deeply rooted in organizations. Staff rely on existing data, information, science and technology to support cooperation and integration. One result of the City's collaborative efforts is a long-term integrated community and asset management plan. This plan clearly establishes goals, performance targets, and responsibilities. It is a mechanism to ensure transparency and accountability.

Overall, the City looks and feels much like it does today with one main difference: water is an undercurrent of the culture. Citizens value water and understand that it is central to their daily lives and activities. Respect for the resource is apparent in how residents choose to operate and live.

Oliver

"By examining all actions in the context of the watershed, we can move toward a governance system that is rooted in ecological principles and shift the focus towards managing the people within a watershed, rather than controlling the watershed itself."

Jean-François

"Open data will likely be the short-term answer to the governance problem. Coordination may be the intermediate solution."

Greg

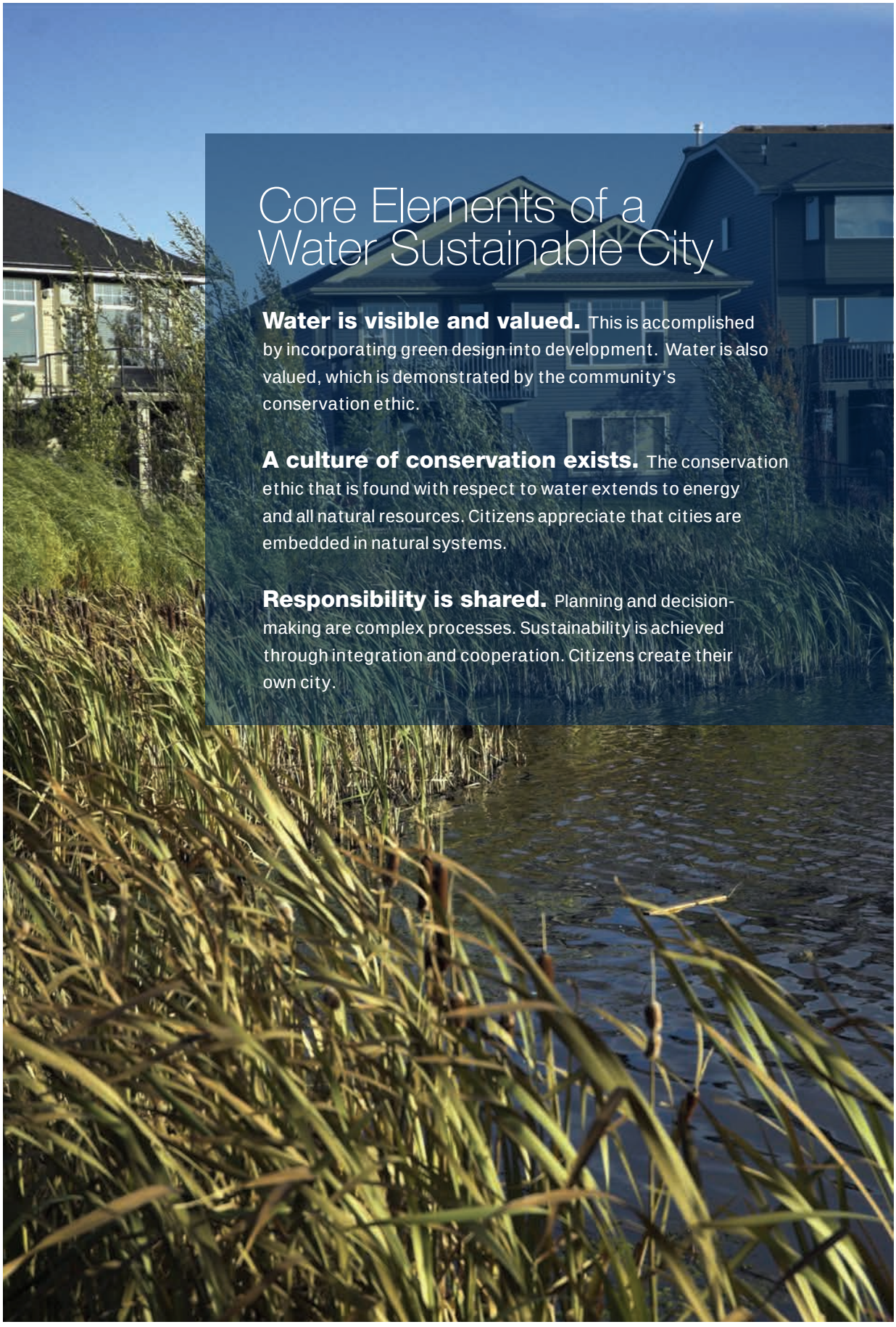
"In Canada, we don't have a national forum on water, on infrastructure, or on the environment that brings all the key players together."

Mike

"People who live in the city will appreciate what they have. Today, people take for granted the water that comes out of their tap. If we don't treat the natural environment with respect, it will only harm ourselves and future generations."

Oliver

"It will be clear through our institutions, incentives, and behaviour that water matters. It won't be an afterthought, but instead brought to the forefront as citizens and communities realize their quality of life is intimately linked with good healthy functioning water systems – the ecological and the traditional built systems."



Core Elements of a Water Sustainable City

Water is visible and valued. This is accomplished by incorporating green design into development. Water is also valued, which is demonstrated by the community's conservation ethic.

A culture of conservation exists. The conservation ethic that is found with respect to water extends to energy and all natural resources. Citizens appreciate that cities are embedded in natural systems.

Responsibility is shared. Planning and decision-making are complex processes. Sustainability is achieved through integration and cooperation. Citizens create their own city.

C.

Digging Deeper:

Exemplary Elements of the Water Sustainable City

While many Canadians will recognize aspects of the City as similar to the place where they live, they will also see that some characteristics of their cities could be improved. Our experts have identified four areas where innovation and leadership could make tangible progress towards sustainability. These include: financial responsibility, progressive regulation, customer-oriented information, and cutting-edge technology. In this story, the elements of each area are conveyed as actions taken by various people in our City.

System Longevity Dependent upon Financial Responsibility

Financial sustainability is integral to the longevity of water systems. The City's administration sets priorities and establishes service levels. Both infrastructure and operational expenses are considered, and revenue models are set to fully recover the costs of delivering these services. Long-term financial sustainability is dependent on maintaining sufficient revenues and controlling cost inflation.

Lay it All Out: Prioritize Services, Calculate Expenses and Determine Who Pays

The City's managers host conversations about water service priorities, communicating the concept of infrastructure risk and reliability to residents. Together, they determine the appropriate "levels of service" — the place on a spectrum of service quality that a utility offers its customers. The levels of service links the organizational outcomes in a strategic plan with the operational plan by explicitly connecting benefits provided by the utility and the natural environment with environmental and financial costs. Sustainability is not only about generating enough revenue, but includes strategically assessing current services for ways to change the cost profile. For example, if a utility uses less water, it may divert a planned infrastructure expansion or reduce operational costs.

The City also has asset management and financing plans in place to systematically and transparently illustrate what funds are required and where the money will come from. They detail the levels of service, regulatory responsibilities and performance targets, capital, operational and conservation costs, and revenue sources.

Embedded in the financing plan are multiple reliable, long-term tools such as debt servicing, development charges, and service fees to cover infrastructure costs. However, enough flexibility is left to include innovative strategies as they are developed, including ones that support efficiencies and demand management programs that may reduce the need for capital expenditures. Funding models consider the interests of each customer group so that costs and benefits are appropriately distributed.

Since assets often last decades, costing and financing large projects must consider inter-generational equity when determining who pays and how. In general, continuous expenses, such as water main renewal should be pay-as-you-go out of operational revenue. Large, one-time projects, such as treatment plants, should be funded in a large part by debt.

Greg

"Infrastructure is a unique service that delivers social benefits through the land-use planning process. Function and form are defined by land use planning; levels of service are established to deliver this. The community pays for three parameters: structural condition, capacity and functionality. We don't do a very good job in Canada of costing out service. Until you can link the cost and environmental impact of service with the levels of service in an informed way, it's very hard to engage the community."

Carl

"Regulators should require utilities to have an asset management plan before they qualify for funding. Reward the well managed rather than bail out the poorly managed."

Carl

"In Halifax, we have three guiding documents: The integrated resource plan says what you have to do for asset renewal, environmental compliance, and to accommodate growth over the next thirty years. The cost of service manual tells you who's paying what — how to break up the pie — and is the basis for determining rate structures. The financing strategy determines how you're going to pay for the services you will provide."

Lou

"A big barrier in Ontario is the fact that the Province focuses only on regulating operations. Full cost accounting provisions are needed so that managers can build a business case to elected officials and the public. We need to make sure financial sustainability plans are in place."

Carl

"Any procurement system where price plays a major part can be a disincentive to adopting innovation. Up to 80 percent of the lifecycle cost of an infrastructure project or system is in the operations and maintenance phase. During design and construction, we need to think about how to minimize operations and maintenance costs."

City managers make sure they calculate infrastructure costs in a manner that integrates capital and operating expenses into an overall life cycle cost. Infrastructure is an ongoing cost in the delivery of water services and must be managed from cradle to cradle. Procurement and accounting practices in the City consider this life cycle cost in decision-making. This is also reflected in the restructured infrastructure grant programs from provincial and federal governments.

"The world's paradigm is about bigger, bigger, bigger, more, more, more. Can we create a financing paradigm that supports less, less, less; more and more efficiency?"

David

"Depreciation is an effective tool for expensing short and mid-term assets. It's not a good tool for expensing contributed assets. We haven't worked out how to consider inter-generational equity in that process."

Greg

"Infrastructure is a recurring problem. You don't solve it once for all time, you solve it continually. Infrastructure is to water services what exercise is to health."

Bryan

"Water conservation costs are currently operational costs, as opposed to capital expenses for infrastructure. So we treat conservation as if it was an expense and infrastructure an investment. In this scenario, good conservation programs will forever be relegated to the edge of priority, instead of a valued asset to be cultivated."

Oliver

"Provincial and federal infrastructure financing needs to continue for smaller municipalities. But the issue of certainty is key – programs are currently start-stop and there is no certainty about whether financing will be granted. We should have a dedicated federal fund for water and wastewater."

Theresa

"Redevelopment is the opportunity to get it right. Impose incrementally higher costs on developers now to avoid societal costs later. There's little cost now to the taxpayer, but a huge cost down the road if you don't get it right."

Kim

Effective Rate Setting Recovers and Communicates Costs

All costs, including water management activities from source to source and over the entire lifespan of infrastructure, are considered when the City's utility determines how much to charge for water. Seattle Public Utilities has been setting its rates based on the principle of full cost accounting for decades. It also uses various types of charges to communicate to customers the costs of service delivery (see Case Study 4).

In the City, the price also accounts for changes in infrastructure performance, increasing business costs and inflation. Customers understand and support this approach to rate setting. To help transition to new rates, the utility ensures clients are given time to react, budget and decrease their consumption. Any increases are done pragmatically, in a manner that is both politically responsible and acceptable to the community. As well, the utility knows that as prices rise, residents will demand efficient operations and evidence that the additional revenue is in fact going towards capital renewal or expansion.

Rain, Rain Don't Go Away

Mimicking the natural environment, the sustainable city of the future is designed so that rainfall is absorbed by the landscape where it can nourish plants and recharge groundwater. The natural water cycle is protected. Runoff volume and sewage overflows are reduced. Rainwater is seen as a valuable resource that supports natural systems.

MURDOCH DE GREEF INC PHOTOS

Lou

"We need to show the public we're maximizing the capital benefit of rate increases."

Theresa

"We need full cost pricing with caveats. With a small population, there is no way you could do this. You need senior government support in those cases. But, for sure, for cities above fifteen to twenty thousand people you could do full cost pricing if people put their minds to it."

Bryan

"Think of it not as paying a tax, but as building a stage. Infrastructure is the stage in a play that lets us get together and do great things."

When designing rate structures, utility managers know they need to cover expenditures. They also understand that pricing sends information to customers about the cost of services and so can incentivize conservation behaviours. For example, fees can reflect the increased costs associated with supplying water at peak demand or to distant suburbs. Managers use models to determine the appropriate combination of fixed and variable charges and to consider how low-income residents may be impacted.

Carl

"The most important thing you can do for promoting demand management is to set the right rate structure. That's the way people pay attention. Find the right balance: Part is a commodity, part is a service. Charge a base fee for the fixed cost and a consumption fee for variable costs."

David

"There should be a significant increase in water prices to reflect the full cost of water delivery including capital costs, a rapidly increasing step rate system and increases for peaking. We should also have differential pricing for wastewater. There's a standard rate if all you're putting into the system is domestic waste, but if you're putting things in that are harder to treat, the cost per unit should increase."

CASE STUDY 4: CONSERVATION-ORIENTED PRICING, SEATTLE

Rate Structures in Seattle Reflect Cost of Service and Influence Customer Behaviour

Seattle Public Utilities (SPU) is an agency of the City of Seattle that provides direct retail water and wastewater service to about 630,000 people in and around the city and wholesale water services to 25 neighbouring cities and water districts serving another 720,000 people. It was established in 1997, merging a number of predecessor agencies.

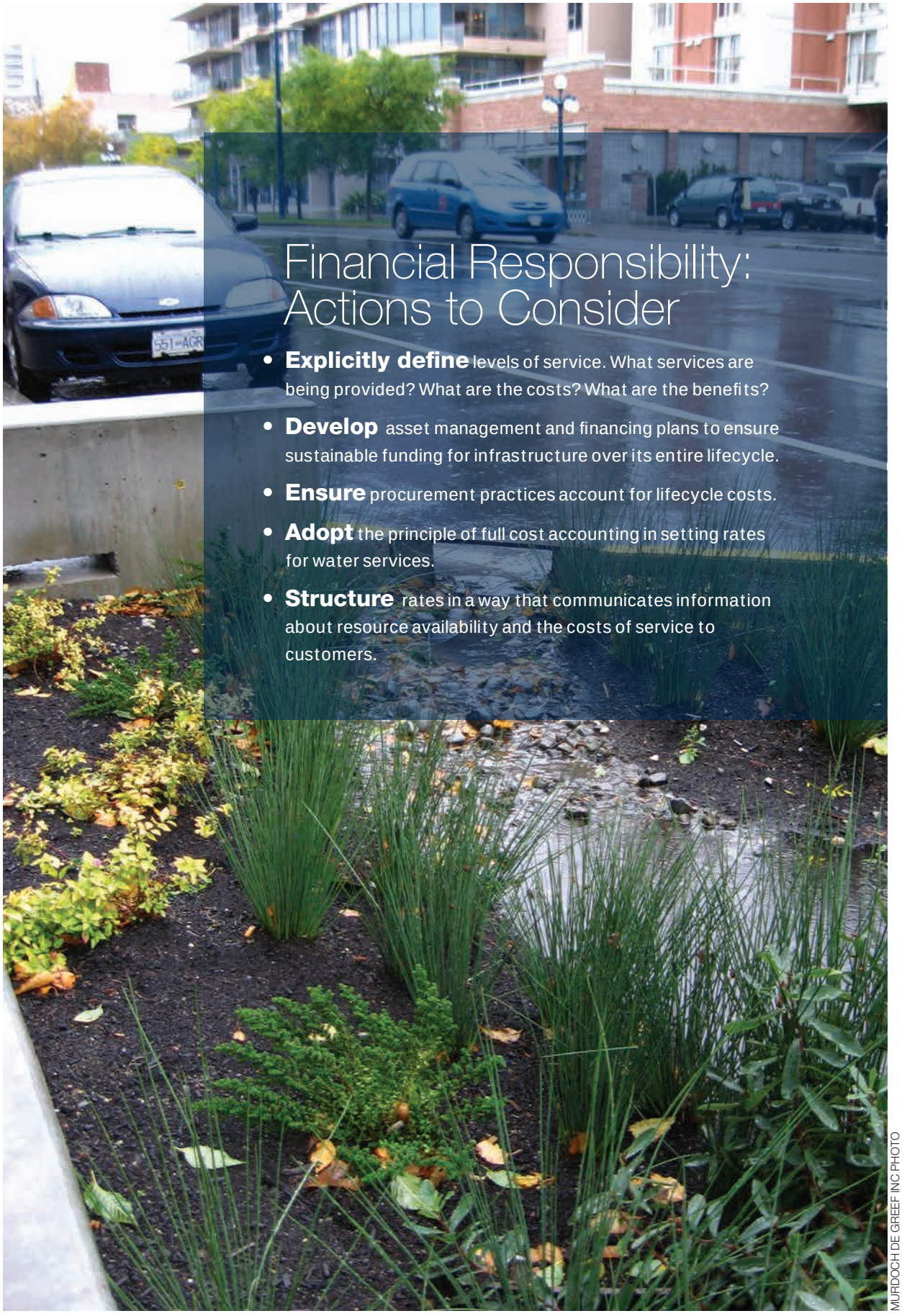
The utility has charged rates based on volume for more than a century and has been fully metered since 1920. In 1989, it was among the first in North America to introduce seasonal surcharges. This was triggered by annual supply and demand patterns that caused supply constraints in the summer. Retail water rates for single family residential customers are based on a uniform price structure during the winter and a three-tier inclining block system from mid-May to mid-September.

The third tier has a significantly higher charge for any usage over a very high volume. This acts as an excess use charge and provides a strong incentive to conserve water during the summer, when supplies are lower and demand is higher. Around 10 per cent of residential customers fall into this category.

In addition, SPU has a uniform volumetric wastewater charge, calculated based on 100 per cent of winter water consumption for single-family residential customers. This assumes that during the winter, non-essential outdoor use is limited and so most water is disposed through a drain into the sewer.

Also, to more equitably assign costs, SPU uses distance (or spatial) pricing for its retail water clients. Providing services to customers outside the city limits adds capital and operating expenses for the utility. Therefore, SPU charges higher rates to communicate the elevated costs of service provision in suburban areas.

Retail prices are determined by "cost of service studies" typically completed every three years and are set to achieve full cost recovery. SPU also has affordability programs that offer bill discounts for qualifying low-income customers.
These price signals, along with an extensive regional conservation program, plumbing codes, and operational improvements, have worked so well that summer demand now rarely stresses the system. In fact, infrastructure expansion has been significantly delayed and consequently the retail water rate design is currently being re-evaluated.



Financial Responsibility: Actions to Consider

- **Explicitly define** levels of service. What services are being provided? What are the costs? What are the benefits?
- **Develop** asset management and financing plans to ensure sustainable funding for infrastructure over its entire lifecycle.
- **Ensure** procurement practices account for lifecycle costs.
- **Adopt** the principle of full cost accounting in setting rates for water services.
- **Structure** rates in a way that communicates information about resource availability and the costs of service to customers.

MURDOCH DE GREEF INC PHOTO

Progressive Regulations and Governance Enable Sustainability

The regulatory system within which the City operates enables and enforces sustainability. Laws, regulations, policies, bylaws, standards — these are all part of the system and together they drive performance, generate conversations and pave the way for technological innovation.

Mainstream Water Conversations: Create a Robust Regulatory Framework

Enhancing the regulatory framework could mainstream water conversations in boardrooms, communities and among consumers. Immediate priorities for the City's leaders include working with senior governments to establish sectoral water conservation requirements, standardize greywater use and enhance non-point source pollution management. Complementary opportunities include developing policy around related issues, such as developing topsoil bylaws and appliance labelling requirements. At the same time, provincial counterparts work on creating regulations to enhance governance processes and facilitate information exchange, including exploring national infrastructure risk assessment standards, water risk disclosure requirements, and service arrangements on private property. City administration often talks about how a national vision, principles and oversight strategy could help to ensure transparency and accountability in water service delivery across the country.

It is well-accepted that regulations can generate progress towards sustainability, particularly when supported by high-level policy that articulates a clear vision and programs that deliver on identified objectives. However, sometimes they lag behind public pressure. In these circumstances, the City's councillors direct and support staff to design programs, incentives and pilots to reach water management targets and respond to immediate needs. An excellent example of this is the City of Chicago's Green Permit Program, which addressed pressure from industry by incentivizing new LEED building development (see Case Study 5).

Theresa

"Water conservation regulations would tell each sector, including public sector institutions, how much they have to conserve. That would include setting targets and enforcement."

David

"Make water and wastewater a liability to corporations. This will make water a boardroom topic, a shareholder topic, a personal wallet topic. If you change transparency in data and regulation around risk disclosure, you probably don't have to increase the price. You'll have massive adoptions."

David

"Minimum performance standards for appliances are easy to understand and they work. Within two years of energy use labelling, the worst fridge on the market was better than the average one before labelling. Labels work. Put them on dishwashers, clothes washers, water softeners."

Chicago's Green Permit Program Sparks Sustainable Neighbourhood Transformation

Chicago is a large city, with a population of approximately 2.7 million (2010). In 2005, Mayor Richard M. Daley led the creation of a vision to make Chicago the "greenest city in the country". Also in 2005, the development industry was frustrated with long wait times to process building permits. Thus began the Green Permit Program.

The program offers developers an expedited permitting process, with a goal of a less-than 30-business day turnaround time, and possible reductions of permit fees — up to a maximum of $25,000. In return, contractors build to LEED standards. It is available for new construction and for alterations, additions, renovations, or repairs to an existing building.

As well, all participants must implement one to three measures on a locally-defined "Green Menu" of strategies and technologies. This ensures local priorities are addressed by the program. The Green Menu includes items such as green roofs, renewable energy, and exceptional energy performance or water management. Some items, such as the green roof, are also accompanied by a credit towards the permit fee.

Recognizing that environmental and community sustainability are intertwined, social priorities including exceptional affordability, transit-oriented siting, outstanding bike parking, and building in difficult-to-develop locations are also included on the Green Menu. Other innovative design strategies are considered individually based on their merits. This ensures the list is both adaptable to new innovations and responsive to site-specific situations.

Since inception, the Green Permit program has proved very popular. It is seen as a success by City staff members who feel that Chicagoans, both developers and their clients, have embraced green building in a meaningful way. In 2012, the Urban Land Institute awarded it the 2012 ULI Chicago Vision Award for its success in transforming communities and neighborhoods throughout Chicago.

Mike

"It's the public who creates the demand. Developers just deliver what the demand is within current standards, laws and policy. If we change the demand, we can change the outcome toward sustainable concepts. The most effective way to do that is through public policy and legislation. It often requires legislation to force the change along with incentives to alter the economics to drive demand in different directions."

Mary Ann

"What we need to do is create specific regulatory structures for building innovative buildings and give them license to replicate. And developers need incentives to build them."

Catalyze Innovation: Explore Performance-Based Regulations

Regulations can catalyze innovation, performance improvement and information disclosure. Elected municipal officials work closely with their provincial counterparts to transition regulations and building codes away from being practice-based and prescriptive, towards defining performance requirements. This creates opportunity for implementing innovative processes and techniques, provided they meet the defined outcomes. The scheme devised by EPCOR water services and the City of Edmonton exemplifies this balance of operational autonomy with regulatory responsibility (see Case Study 6).

In practice, performance-based regulations will help to reduce the phenomenon of one-off pilot projects that require regulatory exceptions — projects that can never be replicated because of onerous bureaucratic processes. For this to be successful, robust public policy must mitigate risk, ensure outcomes are being met and enforce consequences if required.

"Incentivise utilities using performance-based regulations. Coupled with other incentives, regulation can help the industry in the long run by setting water efficiency benchmarks and standards."

Glen

CASE STUDY 6: PERFORMANCE-BASED REGULATION, EDMONTON

Performance-Based Regulation in Edmonton Blends Oversight with Innovation

EPCOR provides water treatment and distribution services to 812,200 residents of Edmonton and its surrounding areas. Since 2002, the City of Edmonton and EPCOR Water Services have operated according to performance based regulations (PBR). This is the key mechanism to control costs, to define expectations, and to lay out penalties for the utility in the case of under-performance.

Every five years, City Council approves water rate structures, performance measures, and the expected return on equity. As a standing rule, rate increases must not exceed inflation. These become the City of Edmonton's Waterworks Bylaw, which govern EPCOR's operations and determine the levels of service provided to customers.

The utility is permitted to make capital and operational decisions, as well as take business risks, so long as they are consistent with the PBR framework. Under-spending may threaten service quality, which could result in penalties, and over-spending would affect the utility's bottom line. Combined with regulated rates, this provides accountability and oversight while allowing operational flexibility to innovate and maximize efficiencies.

Performance measures include benchmarks related to system reliability, customer service, environment safety, and water quality. Performance is assessed every year according to a point system, with bonuses available in some circumstances for over-achievement. After weighting of measures and tabulation of points, an annual score is calculated. If the score exceeds 100, EPCOR is considered to be in compliance with the PBR; however, if less than 100 points are accrued, a performance penalty would be applied.

Including the most recent 2012 PBR report, EPCOR has met or exceeded overall performance measure index benchmarks every year since PBRs were introduced.

Find Resource Efficiencies and Cost Savings: Effective Utility Governance

The mandate of the City's utility includes providing drinking water, wastewater, and stormwater services to residents and businesses. Having these combined under one agency makes it easier to integrate business processes, achieve resource efficiencies, stimulate innovation and optimize information flows. In the long run, integration is likely more efficient, saving money and minimizing service disruptions.

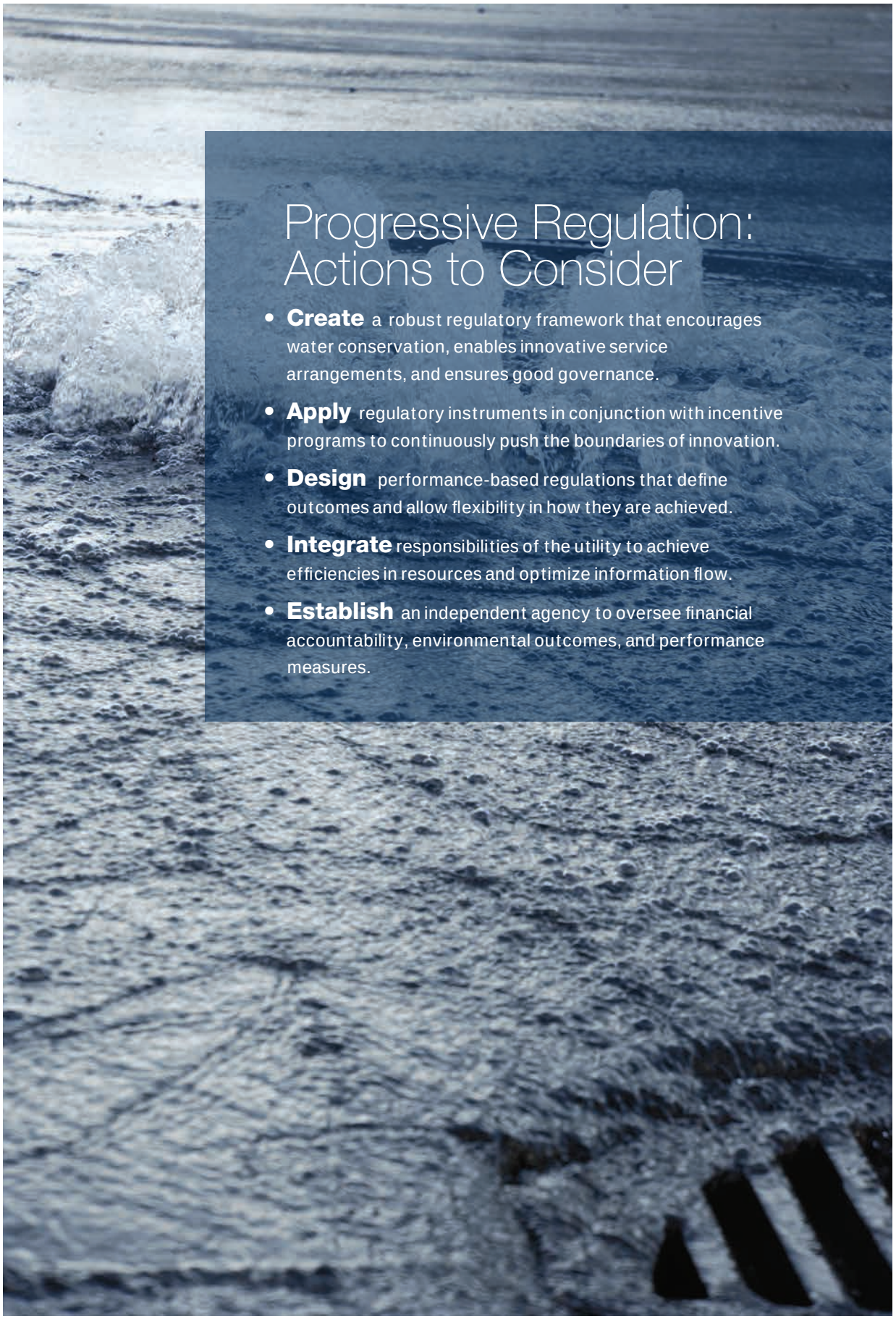
Provincial and Territorial laws and guidelines provide operating principles, including full cost accounting and reporting requirements. As well, the utility's performance and financial practices are regulated by an independent agency, which helps to ensure accountability and transparency.

Greg

"Information flows from the bottom up. Direction flows from the top down. You need alignment. If you don't set up systems to be able to feed information in a meaningful way that aligns with outcomes, you won't be able to make good decisions."

Carl

"Halifax is an example of a regulated integrated utility. Rates are regulated through a quasi-judicial provincial agency to make sure what we are charging is fair and that inter-generational equity is practised. Halifax has to look at past, present and future users to make sure there is equitable treatment. When developing an integrated utility, the first thing you have to look at is governance."



Progressive Regulation: Actions to Consider

- **Create** a robust regulatory framework that encourages water conservation, enables innovative service arrangements, and ensures good governance.
- **Apply** regulatory instruments in conjunction with incentive programs to continuously push the boundaries of innovation.
- **Design** performance-based regulations that define outcomes and allow flexibility in how they are achieved.
- **Integrate** responsibilities of the utility to achieve efficiencies in resources and optimize information flow.
- **Establish** an independent agency to oversee financial accountability, environmental outcomes, and performance measures.

Customer-Oriented Information Lays Foundation for Change

The people who work for the City make customer service a priority. One of its initiatives is to embrace technology to synthesize and filter real-time data in order to provide useful information to those who need it, when they need it. This information supports collaboration between municipal managers, private sector partners and across disciplines in formal education institutions. At the City's offices, staff in charge of community relations and engagement design programs to bring about sustainable change: they identify behavioural barriers and operational issues; they address these through targeted interventions; and, they evaluate their efforts, measure performance and redefine their priorities.

Performance Feedback is a Game-Changer

So that residents living in both single and multi-family homes can understand their water use patterns, the utility provides them with individualized information. This has been a game-changer. Similar to cell phone use and banking information, customers now have real-time data on water consumption. This includes more than high-tech household water meters; it is data from appliances and fixtures, more informative water bills, and creative service provision. In the City, managers are continuously developing new tools to engage effectively with the community.

Another priority for elected officials is figuring out how to make the cost of producing potable water clear to consumers, businesses and investors. An index that compares this cost across multiple jurisdictions could help to inform investment decisions.

The performance of the utility is also measured, including operational indicators and the impact it is having on the environment. For example, the energy use of pumps, distribution network leakage and the quality of receiving waters is monitored. With better information, decision-makers can prioritize improvements to the sustainability of its services.

As well, regular measurements contribute to performance tracking and can be used to inform benchmarks, targets, investment priorities and plans. Halifax Water continually measures specific performance parameters related to its targets and benchmarks. This has led to the development of its internationally acclaimed pressure and leakage management program (see Case Study 7).

Synthesized and Accessible Information Leads to Knowledge Integration

Everyone in the City has a role in knowledge integration, which is crucial to addressing many challenges, not only water sustainability. Councillors develop partnerships to build capacity and to make information accessible. Practitioners endeavour to advance sustainable practices by working together across disciplines, academic departments, institutional divisions and jurisdictions. The utility investigates the role technology and information systems can play in making services more responsive and intelligent.

David

"One trend that's been overlooked is 'The Amazon Effect'. People are starting to ask, 'why can't I see my own water bill and see how much water I'm using'. When you put that data in the consumer's hands, the game changes."

Andrew

"How do we have the people to bring these things forward? Are there enough experts in this field? Think of engineering education: the centralized municipal approach is the one students hear about. Soft water paths and decentralized water ideas have to get more into the university curriculum."

Jean-François

"In transportation we have a real time dashboard — a speedometer. You can get a real-time energy consumption monitor for your kitchen that provides feedback in dollars. People don't have real-time visibility for water. If you only get one water bill a year, how can you expect people to know about their consumption?"

Bryan

"Think of a gas gauge - do I have something in the tank or not? An infrastructure deficit fuel gauge could change the way you make decisions."

Kim

"Develop the tools: a 'water balance model' for cities and a 'water balance model express' for landowners. People learn from playing with numbers. The express model gets landowners thinking about decisions on their site. They will start thinking about assumptions and outputs. Educating with tools that can handle complex data is part of the solution."

Pressure & Leakage Management Initiative Saves Money and Water in Halifax

Halifax Water is the first regulated water, wastewater, and stormwater utility in Canada. It provides services to 350,000 people who live in an area of 5,491 km^2. In 1999, construction of a new water treatment plant was completed in Dartmouth. Because treated water is expensive to produce, and to maximize the quantity being delivered to customers, Halifax Water undertook a pressure and leakage management program.

HALIFAX WATER PHOTO

In 2000, the utility adopted the AWWA/IWA Water Loss Methodology, including a focus on pressure management. Fifty-five pressure zones were converted into 70 District Metered Areas (DMAs) and 1 Pressure Management Area (PMA). As well, a data historian was purchased to store data that has been collected by the SCADA (Supervisory Control and Data Acquisition) system in real time. This made information more accessible and helped staff quickly identify and respond to leaks within the distribution network.

Initial successes were significant, reducing the Infrastructure Leakage Index (ILI) from 9.0 to 3.0. Over the past few years, Halifax Water has worked persistently to achieve its goal of 2.5, which is its Economic Level of Leakage. (This is the level of leakage at which any further reduction would incur costs in excess of the benefits derived from the savings.)

Recently, the utility undertook a study in one of the DMAs that showed how pipe breaks can be reduced by half when they are configured for flow-modulated pressure control. Essentially this means that an automated controller reduces system pressure as demand decreases, typically overnight. Moreover, customers did not perceive a difference in the level of service. This is a promising advanced pressure management technique that could help Halifax address areas prone to leakage.

Halifax Water is quick to point out that their commitment to technology and innovation is only one of the many factors that contributed to their successful program. Pressure and leakage management initiatives have a high level of corporate support, staff are motivated to achieve efficiencies, and successes are rewarded along the way. Organizationally, the utility is structured for accountability and fosters a culture of continuous improvement.

Overall, program initiatives have resulted in a reduction of system inputs from 168 to 130 million litres per day and annual savings in operating cost savings of $600,000.

Jean-François

"In the future, we will have more information about what's happening at every point along water infrastructure. However, we need good baseline information to know what we have to improve. Short term, this will mostly be about leaks and reservoirs. Eventually, we'll look at areas of emerging concern in wastewater. After that, we'll need to be able to integrate watershed monitoring."

Bryan

"We are at the edge of an incredible new synergy between computing power, sensing technology, control technology, and delivery technology. We now have the possibility to make systems that truly are more intelligent, responsive, flexible and sensitive to human desires than they have ever been in the past."

Customer-Oriented Information: Actions to Consider

- **Provide** customers with individualized, real-time information on their water use.
- **Create** a cross-jurisdictional cost-of-water index.
- **Define** utility performance benchmarks; measure and report on performance.
- **Make** information more accessible. How can various sources be integrated? How can services be more responsive?

Cutting-Edge Technology Enables Advances in Conservation

Much of the infrastructure and technology required for sustainability already exists. This is not to say that it cannot be improved, but the immediate task for City decision-makers and contractors is to implement what is already available in a cost-effective manner. The list of innovations in this category is long, so City managers focus on their top priorities: utility configurations, source separation, and clean technology.

New Utility Configurations Lead to New Models of Service Delivery

In Canada, we typically either have centralized treatment systems or onsite systems, although there is a spectrum of possibilities between these. Local circumstances determine the appropriate configuration, but there is a general overall trend towards decentralization to avoid large infrastructure costs. The notable exception is drinking water treatment, as one large treatment plant is a highly efficient way to manage public health risk. In the City, engineers investigate various configurations as infrastructure comes up for renewal. Of particular interest is the technical viability of onsite or neighbourhood rainwater harvesting and stormwater management systems. As well, growing wastewater services in a 'hub' or regional fashion is considered, as it is cheaper to remove contaminants closer to their source.

To complement their studies, the engineers work with planners and elected officials to determine options for new governance arrangements and management frameworks. For the utility, new responsibilities could include installing, operating and maintaining decentralized elements. Or, in a decentralized model, their responsibilities may shift to setting standards and monitoring operations. It is critical to ensure accountability and service standards are maintained. Advances in monitoring technology and new rules about access to private property for service providers will facilitate this trend towards decentralization.

Cate

"Now there's a reliance on the homeowners to monitor and maintain decentralized systems and that's not working. In the future, the system is owned and operated by someone else, it just happens to be on your property. Or you own it, but you have a service contract. This is what we do with natural gas furnaces, for example. We have service contracts to take care of significant maintenance and repair issues."

Andrew

"The big pipe isn't evil: it's efficient at serving millions of people. Things like membranes are coming in to make the big plants better and may even make water treatment more feasible on a small scale. With technology used for monitoring, we can do more things in a decentralized fashion using high-tech treatment and instrumentation."

Wastewater as a Hub: Recovery of Water, Nutrients and Energy

City representatives recognize wastewater as a hub linking water, energy and food production. Greywater is water without heavy contamination, black water has the vast majority of energy and heat, and yellow water contains nutrients. Innovations in source separation enable utilities to recover energy and nutrients, especially at commercial, industrial, and institutional facilities. Although there are currently significant operational and supply chain challenges to making this economical, the situation may be very different in the near future.

Clean Technology Builds on Ecosystem Services

City planners want to take advantage of ecosystem services. Maintenance and enhancements to natural systems become a priority. They look to maximize resource efficiency and accommodate source substitution by encouraging measures such as dual-plumbed buildings and rainwater harvesting systems. Although this scale of green infrastructure has not yet reached Canada, the region of Pimpama-Coomera in Australia demonstrates it is possible for entire neighbourhoods to be set up to use reclaimed water (see Case Study 8). To support this initiative, the City's elected officials endeavour to support and reward entrepreneurs for improving technology that considers ecosystem services.

Carl

"One near-future innovation is advanced digestion of bio-solids, which increases methane gas generation and so can contribute to the energy self-sufficiency of the treatment plant. It also reduces the volume of the bio-solids and manages pathogens so they can be used as fertilizer."

Glen

"We can take advantage of advances in nitrogen removal and a growing understanding of autotrophic biological denitrification. This means that bacteria will take ammonia and nitrite and convert it into nitrogen gas. Historically, we have used carbon to remove nitrogen. By doing this without carbon, we can capture carbon from the wastewater, treat the water more anaerobically, and then use the carbon as an energy source. This will be transformative in producing higher quality wastewater and moving towards energy self-sufficiency of the treatment system."

Andrew

"Although there are market barriers to nitrogen recovery, there's a greenhouse gas argument for intercepting nitrogen as ammonia. Treatment of ammonia requires another stage of aeration, therefore more electricity. Removal could happen from relatively concentrated sources of urine, which is likely possible in large buildings."

Source Substitution on the Gold Coast in Australia Saves 750,000 Million Litres Daily

The Pimpama-Coomera area of the Gold Coast in Queensland Australia is a rapidly growing greenfield development zone that will be home to 120,000 people by 2056. The City of the Gold Coast developed a Master Plan in 2004 that guides implementation of a fully integrated urban water management strategy in the area.

A dedicated "Class A+" recycled water treatment plant and entirely separate pipe system supplies homes and businesses in the area. This water is used for toilet flushing and outdoor irrigation. Because it is highly treated, it can also be safely used for washing cars, filling ponds and firefighting. From street to tap, pipes are coloured purple for easy identification.

Many homes in the area also have large rainwater harvesting systems (originally this was mandatory, but the requirement was later withdrawn and is now voluntary). A typical house has a 5,000-litre tank that supplies the cold water tap for the clothes washer and an optional external tap for filling swimming pools and other outdoor uses.

The Master Plan also places great emphasis on protection of the environment through improved stormwater management using Water Sensitive Urban Design. Street-level elements include swales instead of concrete guttering, drainage ponds, and constructed wetlands.

Implementation has not been without challenges including onerous requirements to manage risks around cross connections. As well, alternative source consumption by residents has been less than expected, which has triggered a major review of the program. Nevertheless, to date, about 5,000 homes have been constructed in the area and nearly three quarters of a million litres of recycled water is being used every day. The Pimpama-Coomera Waterfuture Master Plan remains the largest integrated urban water cycle management program ever undertaken in Australia.

Scott

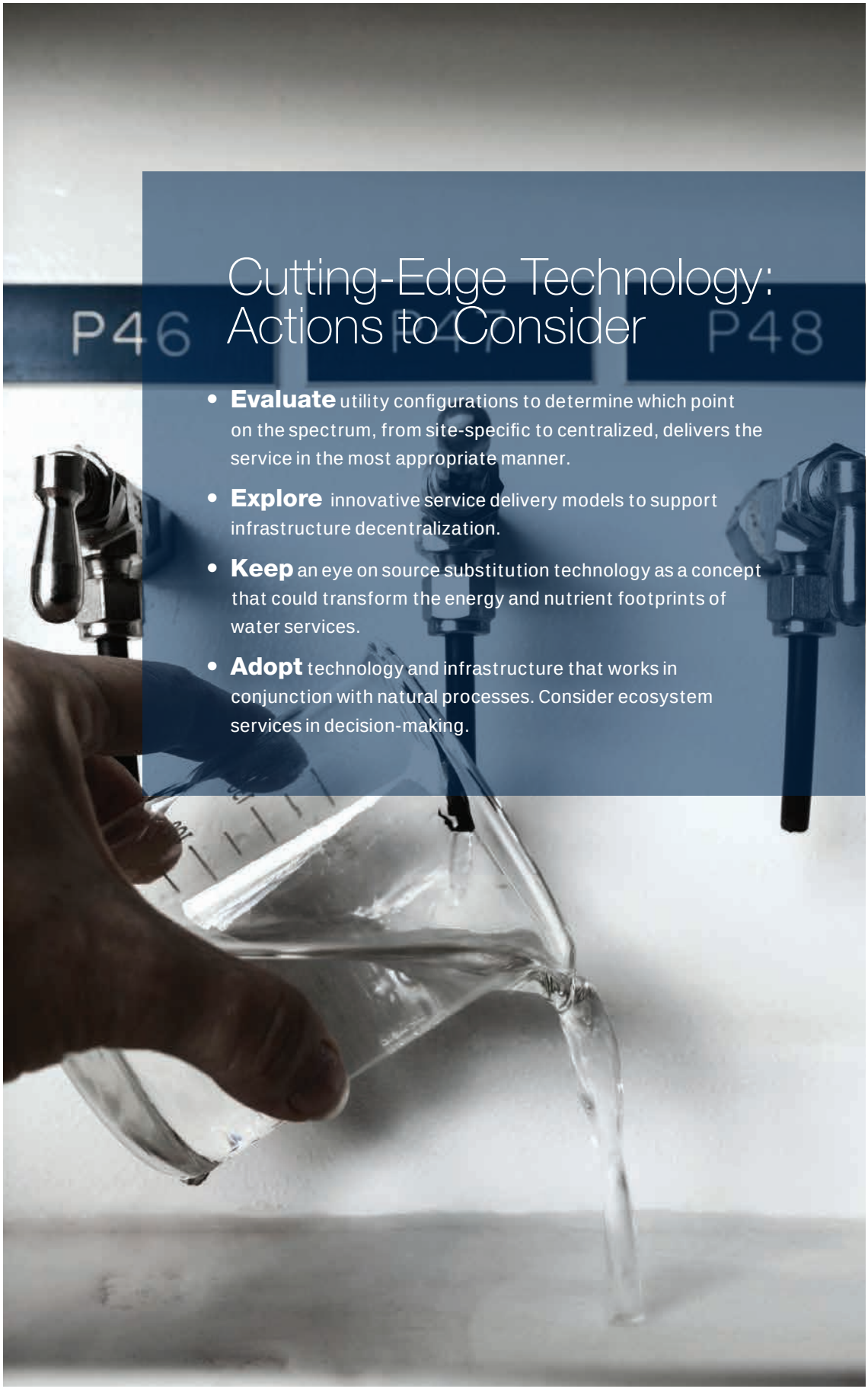
"Treat all road runoff, which is presently discharged untreated into our streams, lakes and oceans. It needs to be able to support life if our urban aquatic ecosystems are to survive. We need to mimic the natural hydrological patterns of a site. Get water into the ground slowly. Deliver it back to creeks cool and clean. Using the natural processes of landscape based treatments is the best mechanism when we factor in performance, aesthetics and economics."

Cate

"Houses would be alternative water ready. Put the infrastructure in now, such as purple pipes or mechanical rooms that can hold a water reuse system or a rainwater harvesting system, so we are ready when the regulations are in place, the technology is robust enough, and the price point has come down. Then it would just be plug and play."

Mary Ann

"We need to create some sort of national recognition that some of these innovations are worth subsidizing. For example, Metropolitan Water District in southern California has a program that gives small grants to test new products. As a result of their $10,000 grant to a spray valve project, the developer was able to evaluate its performance which ultimately resulted in provincial and federal law mandating the use of this specific valve."



Cutting-Edge Technology: Actions to Consider

- **Evaluate** utility configurations to determine which point on the spectrum, from site-specific to centralized, delivers the service in the most appropriate manner.
- **Explore** innovative service delivery models to support infrastructure decentralization.
- **Keep** an eye on source substitution technology as a concept that could transform the energy and nutrient footprints of water services.
- **Adopt** technology and infrastructure that works in conjunction with natural processes. Consider ecosystem services in decision-making.

Four Areas for Action Summary

01 Financial Responsibility

- Sustainable utilities focus on levels of service, develop asset management plans, and embrace life cycle costing.
- Utilities develop new ways of financing capital investments that consider the long timeframe for returns and inter-generational equity.
- In pricing services, utilities aim for full cost recovery and structure their rates to influence behaviours.

02 Progressive Regulation & Governance

- Progressive regulations and incentive-based programs complement each other in driving performance and ultimately achieving water sustainability goals.
- Performance-based regulation effectively separates oversight from implementation, creating flexibility and opportunity for innovative solutions while maintaining accountability.
- A well-designed utility governance structure facilitates information flow and achieves resource efficiencies. An independent regulatory body may enhance transparency and accountability to the public.

03 Customer-Oriented Information

- Service providers give customers personalized feedback on their water use and behaviours, similar to information provided by mobile phone companies, Internet providers and energy utilities.
- Utilities measure their performance. This facilitates transparent reporting and informs planning processes.
- In a sustainable city, information is shared, integrated, and audience-specific.

04 Cutting-Edge Technology

- New utility configurations are formulated around innovative service models for drinking water, wastewater, and stormwater.
- Transformative utilities figure out how to incorporate technology that makes source separation economically viable.
- Sustainable cities have infrastructure that maintains the natural environment and minimizes the impact of activities on native ecosystems.

D.

Pitching Change: Making the Business Case

Now that the vision of a sustainable city has been created and actions to achieve it identified, an argument for implementing the desired change must be made. Although each business case inevitably will be unique, several cross-cutting considerations are likely to inform the arguments. The case must strategically frame the current situation to rationalize an investment or change in course. Successful pitches in the City capitalize on site-specific opportunities, long-term timeframes, and the local political context.

Biggest Pain Points Frame Place-Based Solutions

The City has a unique geographic and demographic context — and water source — that influences its business case. Drivers for change may include water scarcity, approaching the limits of infrastructure capacity, quality concerns, aging infrastructure and aquatic ecosystem protection. They may also include the potential cost of damage from floods or droughts. Whatever the driver is, arguments are typically framed around the City's biggest pain point and are linked to local priorities and development goals.

However, City leaders know that identification of drivers falls short of a business case and that they must make a financial argument for the desired intervention. Reasons for investment may be surprising. Since water is relatively inexpensive in most places, the money saved on utility bills due to conservation may not be enough to motivate behaviour changes. Instead, municipal managers make their case around avoided costs, energy savings and the influence of water on property values. Once full cost pricing and lifecycle costing are in place, making revenues and expenditures transparent, it will be easier for leaders to more clearly articulate the opportunities.

Community engagement specialists ensure they explicitly describe what value is being gained through the proposal. People always want to know 'what's in it for me?' and how the proposal will affect their pocketbooks. Often, resistance stems from a perception that what is being paid for is not worth the amount being paid. Each business case needs to make economic sense for the community.

In the big picture, water practitioners speculate that place-based variability may be a good thing for Canadian entrepreneurs. Technology's export potential relies on its adaptability to a variety of situations, which could be demonstrated by effectively performing in a variety of Canada's site-specific contexts.

Mary Ann

"It all comes down to money. You need to show you're saving people money. Life cycle costing and analysis should be required of all new developers. You need to figure out the financial benefits. And you need to be rewarded for making this step, not penalized. It has to be a good news story for the client too."

Andrew

"We have these great ideas, but we have to figure out what percentage of the problem we are solving. Is the energy we're using for these alternatives more than the energy the conventional system was using? We talk about decentralized systems, but if we have 20,000 pumps across the city, those pumps may use more energy and materials than the centralized system."

David

"There are real drivers to make a business case sound. There is a clear correlation between having clean water sources, proximity to a natural environment, and property value. People pay a premium to buy a house near the water. If you think of a city, what drives all their revenue today? Property taxes. And property taxes are based on property values."

Smart, Long Timeframes Underpin Investment in Water Services

One challenge the City's planners face is that most financial investment occurs on a horizon that is shorter than the expected payback on infrastructure. As well, most analyses are based on today's economics. For a business case to make sense, the planners adopt a long-term timeframe that considers the continuous nature of water services and the lifespan of assets. However, it does so in a manner that is adaptable to change, acknowledging that contexts change and that things that might not make sense today may make great sense 10 to 20 years from now.

As a result of the long payback periods, planners work with economists to explore new ways of financing infrastructure. They see that people pay for cell phones by keeping a plan and make monthly payments to afford a car. No one calculates payback periods for these things because they are a valued part of our daily lives. The economics and affordability of water service technology and infrastructure could change if money to pay for these systems is accessed in a similar manner. City managers evaluate options including taxes, water bills, or even mortgages (as when costs are built into developer charges). They recognize that optimizing value — the triple bottom line — is about more than short-term financial returns. It requires a perspective that extends beyond minimized prices and election cycles.

Scott

"It took 150 years of land and infrastructure development to get to where we are now. Where are we going to be in the next 50 years? We need a smart, long timeline."

Jean-François

"For technology the financing structure is venture capital. What is it for water? If we change some issues around pricing, subsidies, knowledge of resources, quality of resources, maybe then venture capital may go into it. But if venture capital isn't funding water, then what is? Pension funds, which are more patient than venture capital? It needs to be someone with a slightly longer-term outlook."

Mike

"People have a hard time putting things in a context that spans more than a generation. However, people understand the car analogy. If you don't replace the timing belt at 100,000 km, the car may not function effectively a lot longer. If we put infrastructure in simple terms like: 'We built it, we're maintaining it, it's coming to the end of its life, so it needs a higher level of maintenance, and it will cost more as it becomes older. Be prepared to fund it or not have it function into the future.'"

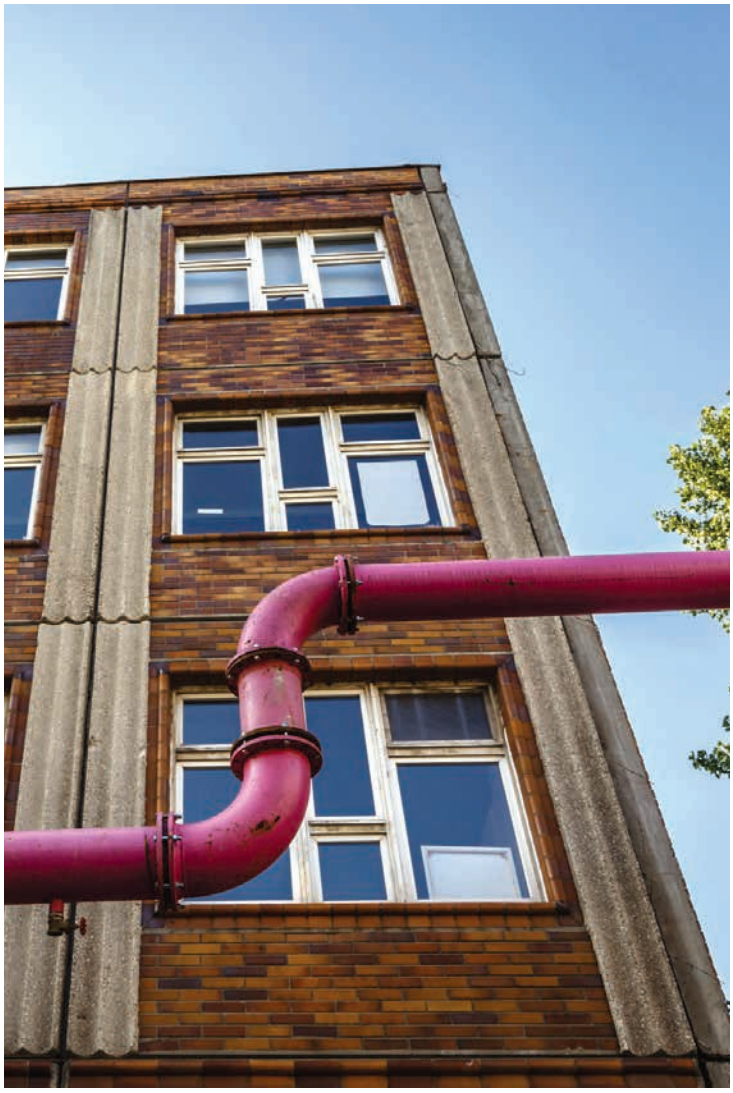
Cate

"Our society accepts the fact that no one has saved up for their car or their furnace, so let's accept the fact that no one has saved up for the funky membrane bio-reactor in their basement. There should be easy-to-access financing options to support these systems in the same way as there are easy-to-access financing options to purchase a new car."

The Right Answer is the One Residents Accept

The City's leaders publish data about water sustainability priorities in order to support a productive dialogue with citizens. Messages use accessible language and, typically, frame opportunities and risks. They shift from promising change to speaking in terms of percentages and probabilities. For example, conversations in the future talk about the likelihood of pipe breaks, water quality incidents, and the lifespan of infrastructure.

When contemplating rate increases, managers know that the public needs to be on board before elected officials will consider them. After a price increase is approved, the utility builds credibility with the community and councillors by reporting back on progress and demonstrating how the money has been spent.



"At the end of the day, the right answer is the one the public accepts. The wrong answer is having the public reject your plan."

Lou

Making the Business Case

- **A successful** business case will be framed around the biggest pain points a city is facing. This will be different for each place.
- **Each case** clearly identifies the value created by the proposition for customers and for the city.
- **Long-term** financial models are necessary for sustainable solutions.
- **The *right*** choice is not only economically and environmentally logical, but it considers public opinion and political preference.

E.

Conclusion

Creating processes that are inclusive of the diversity of opinions around water management is arguably the most challenging part of building a water sustainable city. In closing, our experts remind us that success will inevitably require effective change management — dedicated leadership, managing risk, and celebrating achievements.

With a shared vision, taking small, frequent steps towards creating a water sustainable city is possible. Together, we can navigate diversity and complexity, and ultimately move a real city towards more sustainable practices. The time to plan, to innovate, and to act is now.

Navigating Diversity and Complexity Requires Effective Change Management

Leadership is critical to defining a vision, capacity building and motivation. Leaders are needed everywhere — in government, in politics and in professions — and at all levels, from local to national. Without strong leaders who share a vision of water sustainability, we are bound to continue on the same trajectory as today.

As well, risk is inherent to change and innovation. However, it must be acknowledged that there is also risk in continuing with status quo policies and building practices. There needs to be acceptance that learning and making mistakes are part of moving forward. Water services have traditionally been risk-averse because of their contribution to public health. Instead of avoiding risks, they must be managed. Enhanced risk management frameworks will be an important contributor to change.

Celebrating success — little ones and big ones — will catalyze progress. Hitting a benchmark, modifying a bylaw, and passing a long-term asset management plan are all reasons for celebration. Recognizing achievement is the antidote to cynicism that things will only get worse. By sharing these stories internally, with the community and across jurisdictions it cultivates optimism and confidence that change and innovation are possible.


Greg

”We need national leadership that establishes a framework across all the provinces and territories, for all Canadians including First Nations, in terms of stewardship and governance.”


Theresa

“Whole sectors can change when you get a couple of good champions and good examples. Things can shift once there are a few pathfinders.”


David

“The leaders have to share and promote the vision of the water sustainable city of the near future.”

Glen

"Resistance comes from the industry itself. We tend to say we're a conservative industry and we have to be because we're protecting public health. Are we using these words as an excuse just because we're comfortable? Are we conservative and concerned about achieving the best outcome? Or are we using these words so that we don't have to change?"

Scott

"We need to incorporate some risk. Right now, we design for no risk."

Kim

"Somebody has to build the first one, whatever it is, so that everybody else says, 'What's the big deal? We can do that and we can do it better!"

Oliver

"Collaborative solutions are within reach, calling on successful stories of change."

The Time to Innovate, to Plan, to Act is Now

The *Water Sustainable City of the Near Future* is ours to create. Although it will not be an easy or comfortable process, it will start with dialogue, articulating a common vision and recognizing the value of water. Once the over-arching picture of what the City could look like is established, it will be easier to see the decisions and actions that could move us, one step at a time, in that direction. The business case for making those decisions lies in internalizing the value of water and making the full costs of service delivery transparent.

Change does not have to be dramatic. Building the City is a journey, not an event. The ideas in this story span organizations, jurisdictions, and professions and can be embraced by anyone. The decisions we make today will determine what the City looks like in five, 10 and even 100 years.

Cate

"It comes down to what we value. The first five things we do in the morning require water. Try living without water for two solid days."

Carl

"If the driving factors are in place, such as realistic pricing of water, then that fosters innovation. It's the governance and financial side where innovation first needs to be carried out. The technological innovation will follow."

Mike

"The solution is about developing a sense of collaboration, acknowledgement and people understanding why it's important to make decisions collectively. There is no magic bullet. Educate those involved and build a spirit of collaboration and understanding."

Kim

"A lot of time it's not the exotic. It's doing the smaller, common sense practices that add up to create the big picture."

David

"We are living in that transformational era right now."

Glen

"If we start now, time will be our friend."

Appendix A

A Look Behind the Scenes: How We Compiled this Work

Seventeen innovators, subject matter experts and thought leaders from a variety of specializations were interviewed. The participants were selected for their ideas, and not to represent the organization for which they work. Their opinions do not necessarily reflect the opinions of their employers.

Interview methodology began with contacting 10 thought leaders selected by the project team. These leaders then identified several additional experts. An appointment for each was booked ahead of time and a discussion guide and project summary were sent in advance via email. Participants were asked to review both documents prior to the conversation. The interviews were conducted and recorded via Skype and were semi-structured in nature, lasting approximately one hour each.

Each conversation began by describing physical aspects of the City. What does it look like? What is it like to live in? How is it different from the cities we currently occupy? From there, difficult questions were posed: If you could do only one thing, what would it be? What are the top five things? What do you know that will surprise others? Each person drew from his or her unique specialization and offered a suggestion — or many suggestions. Next, attention turned to building the rationale for implementing these great ideas. Why would we want to change? What would need to be in place to encourage change? What are the barriers and opportunities? Subject matter experts were asked to comment on the questions in the discussion guide, illustrating comments using examples from their experiences.

Interview recordings were reviewed and comments were coded into themes, which form the basis for this report. So that the colour of these conversations is retained, the interviewees 'speak' in each section of the report through extensive use of direct quotes, an attempt to credit the breadth, depth and thoughtfulness of their insights. The summary sections of the report are intended to capture common viewpoints. The summary and quotes are reflective of the ideas provided by the interviewees and are not intended to be a comprehensive overview or analysis of the theme.

Afterwards, a copy of our draft report was sent to each participant by email to review for accuracy. Some individuals provided additional feedback, which were incorporated into the analysis.

Appendix B

Biographies of Interviewees

Jean-François Barsoum
Senior Managing Consultant, IBM

As an IBM Senior Managing Consultant, Jean-François has provided strategy advice to a diverse set of clients. He has spoken on innovation, smarter transportation and climate change on four continents. He helped develop core concepts for IBM's Smarter Cities initiative and deepened IBM's engagement with several North American cities. With training by Nobel Peace Prize Winner Al Gore, he regularly presents material based on the movie "An Inconvenient Truth". He is on the boards of the Climate Reality Project and the Canadian Water Network, and is a member of the David Suzuki Foundation's steering committee.

Carl Bodimeade
Water & Wastewater Practice Leader, Hatch Mott MacDonald

Carl has 30 years of experience in project management and engineering for a wide range of projects in the water supply and wastewater treatment, urban infrastructure and brownfield development, power and industrial sectors. He is a Senior Vice-President of Hatch Mott MacDonald (HMM), responsible for strategy and business development of the Canadian business unit. Carl is also the Water & Wastewater Practice Leader for HMM's Canadian operations. Carl presently serves as the Chair of the Ontario Coalition for Sustainable Infrastructure.

Oliver M Brandes
Senior Research Associate and Co-Director, University of Victoria's POLIS Project on Ecological Governance

Since 2003, Oliver has led the Water Sustainability Project, part of the University of Victoria's POLIS Project on Ecological Governance. He currently serves as a Co-Director of POLIS. His work focuses on sound resource management and ecological based legal and institutional reform. Oliver is also an adjunct professor at the University of Victoria's Faculty of Law and in the Public Administration program. He is a political ecologist with a diverse educational history, including a Master of Economics, a law degree, training in ecological restoration, and studies in international relations. Oliver has authored over 100 peer-reviewed reports and articles.

Dr. David B. Brooks
Author and Water Advisor

David was educated in geology and economics and spent much of his professional career with the International Development Research Centre. He now advises several Canadian non-governmental organizations, including the International Institute for Sustainable Development and the POLIS Project on Ecological Governance (University of Victoria). His main research interests are split between water soft paths and demand management in the Middle East, with particular emphasis on Israel and Palestine. David has written many books on these topics. In 2012, he received an honorary doctorate of environmental studies from the University of Waterloo.

Greg P. Chartier
Independent Consultant

Greg is internationally recognized for his leadership in managing public sector infrastructure. He was an early innovator (1991) in formally evaluating modern asset management principles and practices, and extending them to a customer-centric business model. More recently he has evolved practices to include social, economic and environmental sustainability reporting. Greg has 29 years of experience in municipal infrastructure management and has been involved in the implementation of strategic asset management systems for water distribution, wastewater and stormwater collection, and roads and sidewalks. He regularly authors articles on infrastructure asset management.

Glen T. Daigger
Senior Vice President and Chief Technology Officer, CH2M HILL

Glen is a recognized expert in wastewater treatment, especially the use of biological processes. He is Senior Vice President and Chief Technology Officer for CH2M HILL, where he has been employed for 31 years. He is the company's first Technical Fellow, an honor that recognizes his leadership in the development and implementation of new technology. As Chief Wastewater Process Engineer, he is responsible for municipal and industrial wastewater treatment projects globally. Glen is the author or co-author of over 100 technical papers, four books and several manuals. He holds nine patents and has won numerous awards in his field.

Lou Di Gironimo
General Manager, Toronto Water

Lou is General Manager of Toronto Water, a division of the City of Toronto. Under his leadership, the staff focuses on providing quality services such as supplying drinking water, treating wastewater and managing stormwater and water infrastructure. Toronto Water is responsible for providing drinking water to more than 3.1 million people and treating wastewater for 2.6 million people. The division consists of six sections and more than 1,700 employees. Lou has a diverse background in both the private and public sectors, including municipal and provincial levels of government. He has extensive experience managing municipal infrastructure and urban development issues.

Mary Ann Dickinson
President and CEO, Alliance for Water Efficiency

Mary Ann is President and CEO of the Alliance for Water Efficiency, a non-profit organization dedicated to promoting the efficient and sustainable use of water in the United States and Canada. She currently serves as Chair of the "Efficient Urban Water Management Specialist Group" for the International Water Association and is a board member of the U.S. Water Alliance and the Texas Water Foundation and River Network. Mary Ann is on the advisory board of California State University's Water Resources and Policy Initiatives. She has over 35 years of experience in water resources and has presented numerous papers across North America and internationally.

Mike Hausser
Director of Asset Management, City of Cambridge

Mike has led the development and implementation of leading edge technologies for over 18 years in local governments. Over the last six years, as Director of Asset Management at the City of Cambridge, Mike has worked towards sustainable infrastructure practices and is making significant progress in resolving a deep infrastructure deficit common to most municipalities across North America. Through the application of advanced database and GIS technologies, many of the processes developed by his teams and business partners have become best practices, tools and methods now being adopted throughout the industry.

Andrew Hellebust
President, Rivercourt Engineering

Andrew is a chemical engineer who has been working on biological wastewater treatment systems since 1994. The scale of his work has ranged from individual residences to large industrial systems. In 2008, Andrew founded his company, Rivercourt Engineering, where he designs potable and non-potable water systems. As a research associate with Fleming College's Centre for Alternative Wastewater Treatment, he developed a novel hybrid horizontal and vertical flow wetland. Andrew has authored a book chapter and articles on sustainable infrastructure, energy use, ecological water balance, and resource recovery.

David Henderson
Managing Director, XPV Capital Corporation

David is the founder and Managing Director of XPV Capital Corporation, an investment firm that specializes in high growth water companies. He is a respected speaker, and has been featured by leading news networks, magazines and newspapers. David is advisor to Imagine H_2O and Artemis 50. He is a member of the Water Environment Federation's "Global Water Strategies Council" and the China Greentech Initiative, and is a board member of the Ontario Water Technology Acceleration Project. David's leadership has been recognized through awards such as the Advancing Canadian Entrepreneurship Global Champion, the Premier of Ontario's Award of Excellence and Canada's Top 40 Under 40.

Bryan W. Karney
Associate Dean of Cross Disciplinary Programs, University of Toronto

Bryan is a Professor of Civil Engineering and the Associate Dean of Cross Disciplinary Programs at the University of Toronto. He is also a principal of HydraTek & Associates Inc., a hydraulic transient analysis specialty firm. He has almost 30 years of direct experience in providing hydraulic and hydraulic transient consulting services on a wide range of fluid pipe systems, including water, wastewater, oil, gas and jet fuel. Bryan has spoken and written extensively on subjects related to water resource systems, energy, hydrology, climate change and engineering education.

Theresa McClenaghan
Executive Director and Counsel, Canadian Environmental Law Association

Theresa is the Executive Director and Counsel with the Canadian Environmental Law Association, a position she has held since 2007. Before that she was senior water policy advisor to Ontario's Minister of the Environment. Theresa has also practised civil litigation and environmental law in private practice for 13 years and at CELA for 8 years. She holds an LL.B., an LL.M. in Constitutional Law, and a diploma in environmental health. Theresa has appeared before many tribunals and Courts in Ontario and Canada.

Scott Murdoch
Principal, Murdoch de Greef Inc.

Scott is a fisheries biologist, landscape architect and environmental designer with over 20 years of environmental and urban design experience. He is passionate about fish, streams and water, and the integration of these into urban landscapes. He has successfully integrated natural system processes and design elements into residential, commercial, streetscape and municipal/regional park designs in many Vancouver Island communities, such as Fisherman's Wharf Park, the Atrium Building and Reliable Controls Headquarters in Victoria. Scott holds a Master's degree in Landscape Architecture.

Cate Soroczan
Senior Researcher, Canada Mortgage and Housing Corporation

Cate is a senior researcher in the Sustainable Housing Policy and Research Group at Canada Mortgage and Housing Corporation. Cate's research areas include: water conservation and reuse, rainwater harvesting, onsite wastewater management and innovative stormwater management. Cate worked with Health Canada on the development of the Residential Water Quality Reuse Guidelines, with the BNQ in the development of a national standard for onsite wastewater systems and with the CSA in the development of standards for water reuse and cisterns. Cate sits on the Task Group examining options for incorporating water use efficiency into national building and plumbing codes.

Kim Stephens
Executive Director, Partnership for Water Sustainability in BC

Kim is an engineer-planner with four decades of experience. He specializes in public policy and integration of perspectives as they relate to urban watershed protection and restoration. Kim has led a series of provincial initiatives related to water sustainability, rainwater management and green infrastructure. He has spoken on 'the British Columbia experience' at forums in Australia and throughout North America. Since 2003, Kim has been responsible for developing and delivering the Water Sustainability Action Plan for British Columbia, the partnership umbrella for initiatives that promote a water-centric approach to community planning and development.

Carl D. Yates
General Manager, Halifax Water

Carl is General Manager of Halifax Water, the first regulated water, wastewater and stormwater utility in Canada. Carl has worked for Halifax's water utility since 1988, holding the General Manager position since 1994. Halifax Water is a body corporate municipal utility, generating approximately $105 million in annual revenue with assets of over $2 billion. Carl is Chair of the "Research Strategy Committee" of the Water Research Foundation, and a board member of the Canadian Water Network and Special Olympics Nova Scotia.

The ideas, opinions and views of the interviewees do not necessarily reflect those of their employers or the organizations they represent.

Our Partners

At 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 fresh water 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.

CANADIAN WATER NETWORK
RÉSEAU CANADIEN DE L'EAU

WALTER & DUNCAN
GORDON FOUNDATION

RBC
RBC Blue Water Project™