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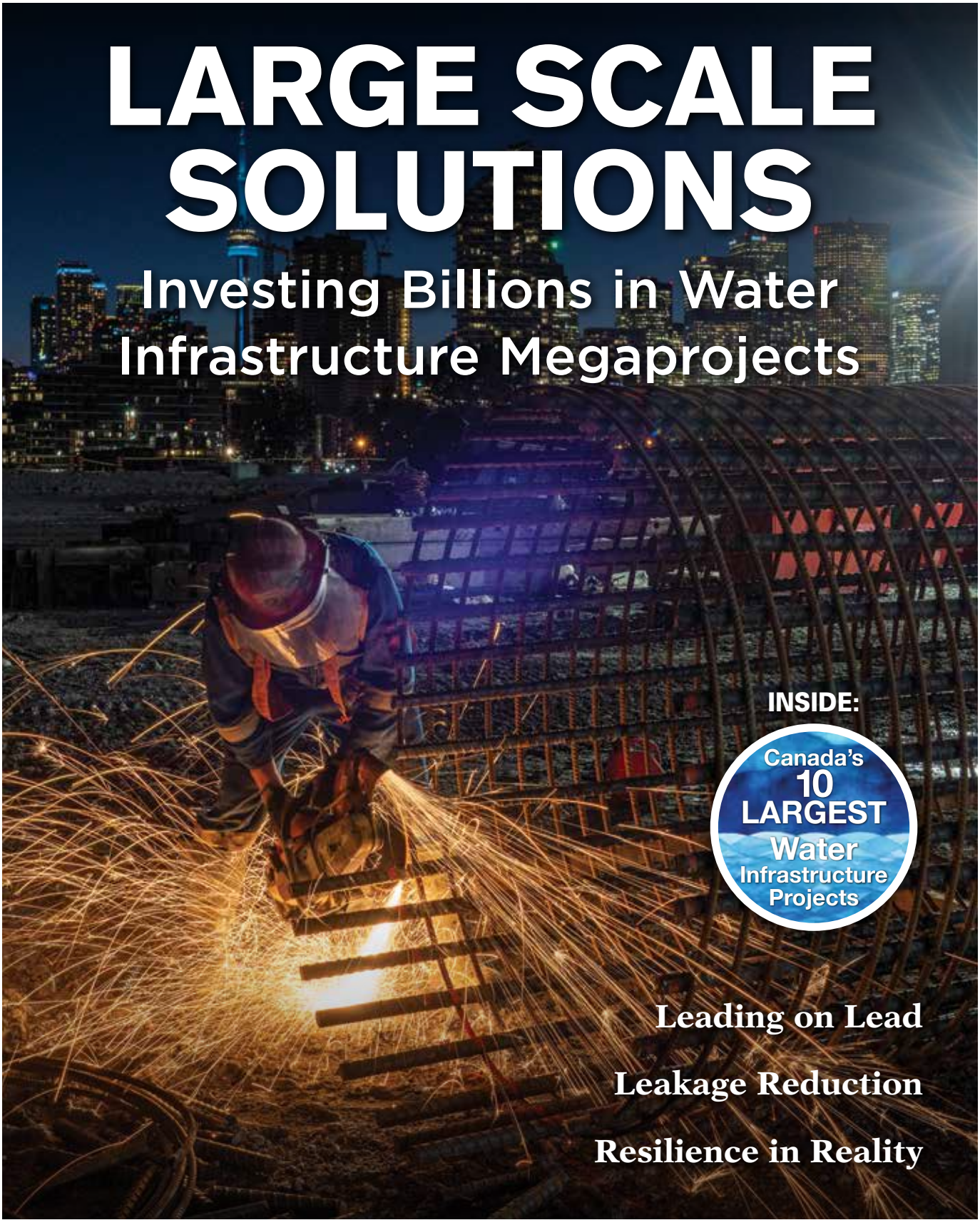

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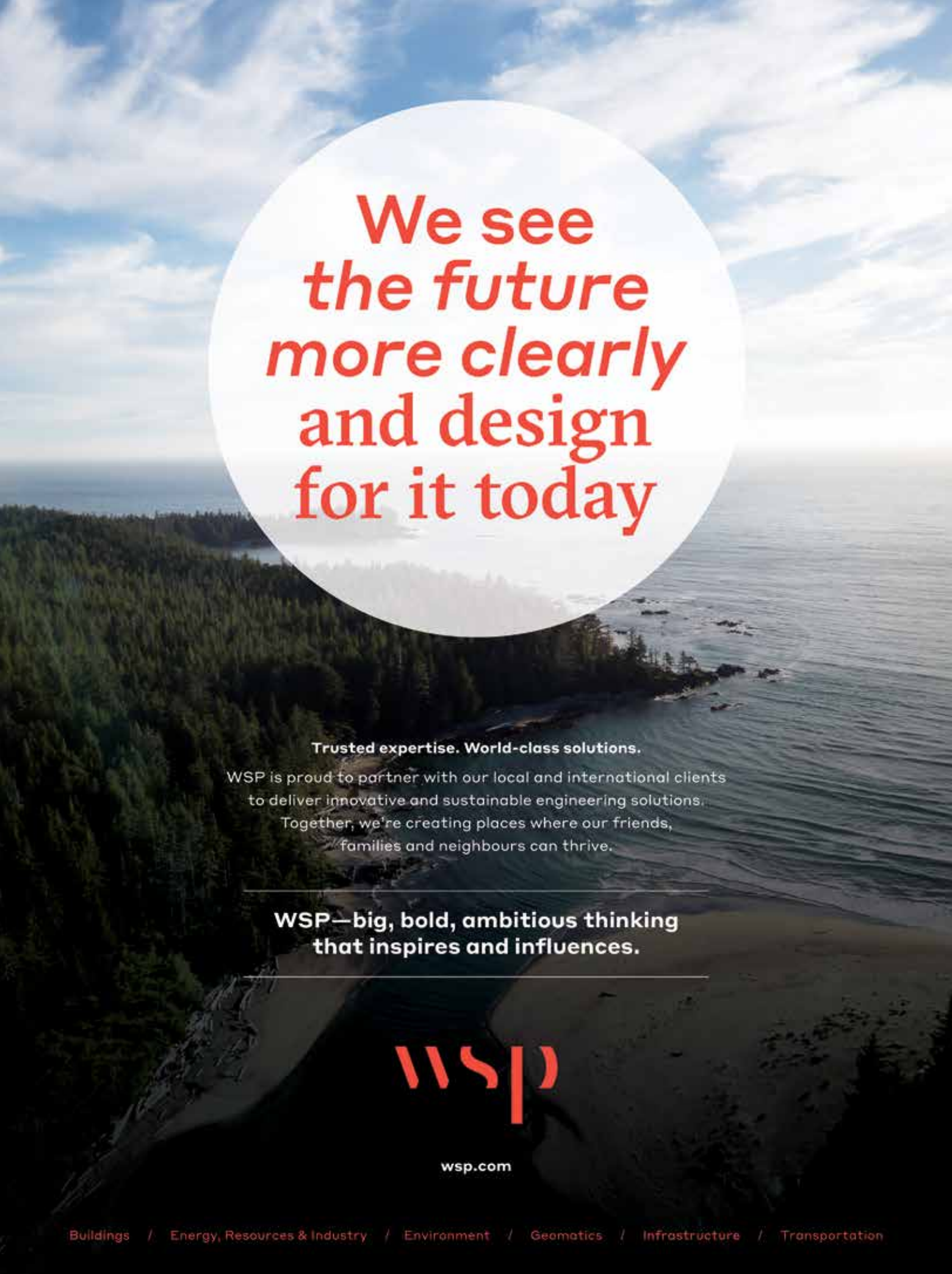
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MANAGING EDITOR
Andrew Macklin

GROUP PUBLISHER
Todd Latham

PUBLISHER
Nick Krukowski

ART DIRECTOR AND SENIOR DESIGNER
Donna Endacott

ASSOCIATE EDITOR
Simran Chattha

CONTENT CONTRIBUTORS
Valerie Bertrand, Kelsey Beveridge, Bradley Jenks, Glenn Milner, Fabian Papa

ADVERTISING
Nick Krukowski nick@actualmedia.ca

ADVISORS
Nick Reid, James Sbrolla

WATER AMBASSADOR
Lee Scarlett

actualmedia

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Hope for the Next Conservative Leader

BY ANDREW MACKLIN

PERHAPS THERE WAS NO REASON for me to be hopeful, but I had hope anyways.

When federal Conservative leader Andrew Scheer announced that he was leaving the role, I was cautiously optimistic. After all, we just finished a federal election that saw the issues surrounding climate change rise to the forefront of the national dialogue. I was hopeful that this would resonate with those stepping up to run.

I was hopeful.

But those hopes, to this point, had been dashed. I am saddened that, just a few short months later, it doesn't seem like the Conservative Party of Canada learned anything from the conversations had in communities suffering from damaging floods, crippling droughts, and fire-scorched earth.

I was hopeful.

Then I remembered the politics. I remembered that, in order to become the Conservative leader, you have to speak to Conservatives. You are not yet in a position where you have to make concessions to the centre or make sense of the left, you just have to speak to your own. And Conservatives, well, if you don't mind my momentary stereotype, rarely listen to complaints about the environment. What they listen to is the almighty dollar.

And again, I have hope.

I have hope because the dollars and cents of the water and environment conversations are starting to add up. Look no further to the (arguably) most Conservative of Canada's provinces, Alberta, a province that is racing to make a $432 million investment to prevent another $5 billion flood. Or perhaps we should look a little further east, to Manitoba, where a $540 million outlet channel can't be built soon enough to combat worsening flood impacts.

The cost benefit of these water-related stories, so brutally obvious in their most basic form, can easily steal the attention of any politician whose primary concern is the economic argument. An evidence-based argument that clearly compares dollars: spend this much now or spend this much more later.

My hope turns to optimism.

As upsetting and frustrating as the current climate impacts are in our country, they are helping us make the investment case to all political stripes. Because no matter how much even the most conservative politician may cringe at the mounting voice of the environmental lobby, the business case is backing it up. Flood-resilient solutions are cheaper than floods. In so many communities across Canada, we have the fiscal numbers to back that up. Whether it's reservoirs, wetlands, outlet channels, bioswails, or other infrastructure that allows us to divert stormwater to prevent flooded homes and communities, the solution costs less than the problem.

This is the case we can make regardless of who replaces Mr. Scheer as the new leader of the Conservative Party of Canada. And this is the case that we will make.

I am, again, hopeful. WC

Andrew Macklin is the managing editor of Water Canada.
andrew@actualmedia.ca

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NATHAN T. WRIGHT
Nathan is a freelance illustrator and artist based in Des Moines, Iowa, USA.
PG 8

GLENN MILNER
Glenn is a climate change adaptation and resilience specialist with Savanta.
PG. 16

BRADLEY JENKS
Bradley is an engineering assistant at HydraTek.
PG. 24

FABIAN PAPA
Fabian is a director at HydraTek.
PG. 24

ABOUT THE COVER

Billions of dollars are being invested by governments across the country to address the need for large-scale water infrastructure, including the Port Lands in Toronto. Learn more on page 18. Cover image courtesy of Vid Ingelevics/Ryan Walker/Waterfront Toronto.

Canada Releases Draft Science Assessment of Plastic Pollution

THE DRAFT SCIENCE ASSESSMENT of Plastic Pollution, which sheds light on the extent of the plastic pollution problem in Canada, has been published by Environment Minister Jonathan Wilkinson and Health Minister Patty Hajdu.

"Science confirms that plastic pollution is everywhere and is negatively impacting our environment," said Minister Wilkinson. "This assessment will inform our decisions as our government follows through on our commitment to ban harmful single-use plastics as soon as 2021 because Canadians expect us to."

The Assessment reviewed the available scientific information regarding the impact of plastic pollution on the environment and human health. It confirmed that plastic pollution is everywhere in the environment, including surface water, groundwater, and drinking water.

The Assessment highlighted the evidence that showed the negative effects of microplastics on animals and the environment. It also noted uncertainties regarding the potential for effects on humans, which required more research. In addition to this, the report looked at the impact of larger plastic items, like bags and straws, on wildlife.

This draft science assessment of plastic pollution will help inform the Government of Canada's actions and policies as it follows through on its commitment to ban harmful single-use plastics. The government is working to have new regulations in place as early as 2021, where supported by scientific evidence and warranted.

The Government of Canada will also be investing in research that will help expand our understanding of the impacts of plastic. WC

Share your story about the Canadian water industry with Water Canada!

Email Managing Editor Andrew Macklin at **andrew@actualmedia.ca**

New National Standard for Flood Resilient Communities

THE CSA GROUP, with the support of the Standards Council of Canada (SCC), has designed a new standard that aims to reduce the impact of frequent and intense flooding events on new communities.

"Fueled by climate change, flooding is the most common and costly natural disaster impacting Canada," said Natalia Moudrak, director of climate resilience at the Intact Centre on Climate Adaptation. "Recognizing that flood risk is on the rise across Canada, the adoption of this new standard by developers, homebuilders, and municipalities should be a national priority."

CSA/W204: Flood Resilient Design of New Residential Communities is aimed at making communities more resilient to flooding, even before the shovel hits the ground in new subdivisions. This NSC gathers requirements and recommendations for designing and building flood resilient communities. It also provides guidance on how to manage with increased urban development and aging infrastructure.

The standard captures a holistic view of planning and development—from the watershed level to the operation and maintenance of stormwater infrastructure. It also lays out what needs to be done from the earliest stages to ensure that communities can recover quickly from severe flooding events.

"This important new standard for greenfield residential development was developed by water management experts," said Barbara Veale, director of planning and watershed manager at Conservation Halton. "Its guidance should assist provinces, municipalities, and watershed agencies, such as Ontario's Conservation Authorities, to avoid negative economic, social, and environmental impacts of flooding from overflowing rivers and excessive overland runoff. I would encourage jurisdictions responsible for flood management to adopt this standard (at a minimum) and incorporate it as part of an overall climate change strategy." WC

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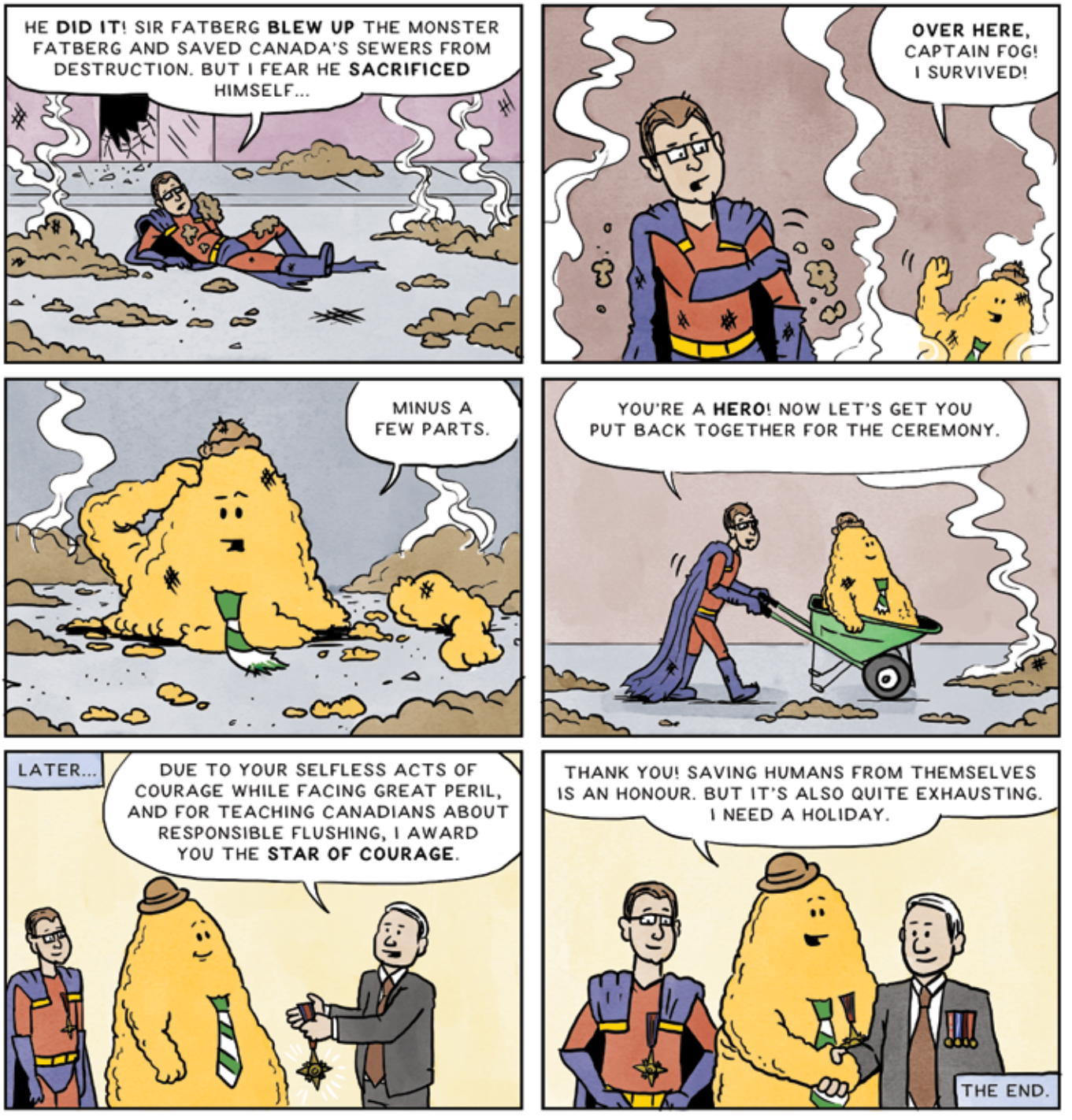

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Nathan T. Wright is a freelance illustrator and artist based in Des Moines, Iowa, USA.

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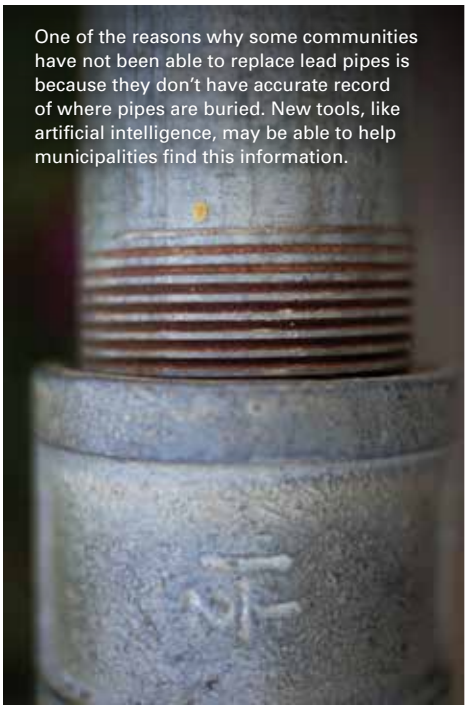
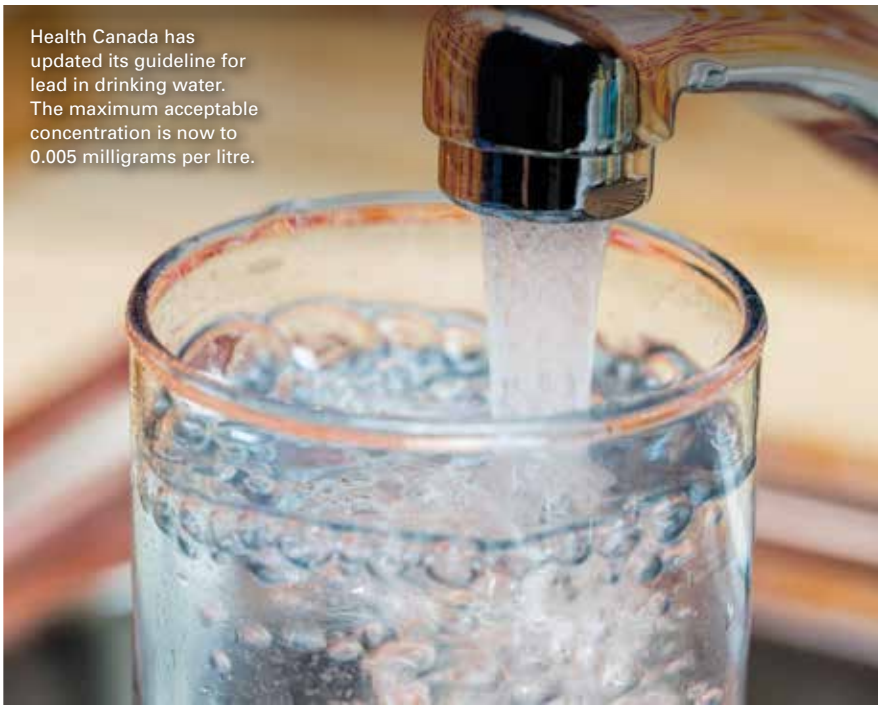


One of the reasons why some communities have not been able to replace lead pipes is because they don't have accurate record of where pipes are buried. New tools, like artificial intelligence, may be able to help municipalities find this information.



Health Canada has updated its guideline for lead in drinking water. The maximum acceptable concentration is now to 0.005 milligrams per litre.

A Roadmap for Lead

What is needed to remove lead from drinking water in Canada?

BY SIMRAN CHATTHA

WHAT'S HOLDING US BACK from replacing lead pipes in Canada? What are some tools that can be used to incentivize and accelerate the replacement of lead pipes? What more is needed to address challenges with replacing lead pipes?

These are some of the important questions that stakeholders across Canada are asking to ultimately ensure that residents have access to safe, clean drinking water. Solutions are available to help communities efficiently and effectively replace lead infrastructure. Before we dive into the solutions, let's look at the bigger picture.

Current state of affairs in Canada

In March 2019, Health Canada set a new guideline for the maximum acceptable concentration of lead in drinking water. The new concentration was lowered to 0.005 milligrams per litre, making it more stringent than the 0.01 milligram per litre guideline that was set in 1992.

"Health Canada's review stated that there is no safe level of lead but setting a guideline of zero is completely unachievable," according to Michele Grenier, executive director of the Ontario Water Works Association (OWWA). "So what it asked was: what is the blood lead level, in micrograms per decilitre, at which there are no observable or minimal observable health effects in children?"

"Health Canada recognized that water is not the only means of lead exposure in children so it set a guideline that said that the concentration of lead in drinking water cannot be more than 0.005 milligrams per litre," Grenier added. "It's related back to minimizing blood lead levels and it's the world standard at this point to my knowledge."

In November 2019, eight months after Health Canada's updated guideline was released, mainstream media outlets in Canada reported on elevated lead levels in the drinking water of several cities across the country.

The fear created by the mainstream media storm was unfounded to an extent. The reporting didn't consider the municipal programs already underway to replace lead pipes. It also didn't consider how lead pipe replacement programs would be funded if municipalities were to accelerate the removal of lead pipes.

At the same time, the mainstream reporting led to a number of important conversations about the need to replace lead pipes in communities across Canada.

One of these conversations took place during a Lead Roundtable hosted by Water Canada and its sister magazine, ReNew Canada, in January 2020. The roundtable brought together about 20 industry stakeholders that represented associations, academia, utilities, technology providers, and infrastructure firms to answer some key questions, including the ones below.

What's holding municipalities back from replacing lead pipes?

One of the challenges discussed during the Lead Roundtable hosted by Water Canada and ReNew Canada was that many communities don't have accurate records of where their pipes are buried. The lack of information had led an obvious problem in some communities:

municipalities can't replace all of their lead pipes if they don't know where they're located.

Politics also came up as a factor that's holding communities back from replacing lead pipes.

"The elephant in the room, that no one is talking about, is politics," said Shaun McKaigue, president and chief executive officer of FER-PAL Infrastructure. "Nothing happens without politics. I spend my life talking with mayors and trying to get them to spend money."

"On what?" asked McKaigue. "Mayors will say 'Shaun, you're a nice guy. But I have to get re-elected three years from now. Right now, you turn on the tap and water comes out. You want me to spend a million dollars. After I spend the million dollars of the tax payers money, I turn on the tap and water comes out. Why would I do that? How do I get a vote out of it?'"

"Unless the mayor is supported by the voter, it doesn't matter," added McKaigue. "The risk is losing the election and mayors are not willing to take that risk. All day long."

Part of this comes down to the fact that "it is hard to get support for any water and wastewater infrastructure projects when they have to compete within a limited budget against recreation, transit, housing, policing, fire and more," said Robert Haller, executive director of the Canadian Water and Wastewater Association (CWWA).

It's not to say though that local governments are unwilling to replace lead infrastructure. Tools can be provided, by provincial governments as an example, to local governments that help build the case for replacing lead infrastructure.

"When we ask the provincial or federal governments to place conditions on funding—such as having an asset management plan or full-cost pricing—it seems like we are asking them to force us to act intelligently, the way we want to," Haller said.

"Mayors, and those of us in the water sector, count on the senior levels of government to create mandatory standards that will identify our unseen projects as a higher priority," added Haller. "Canadian communities compete against each other for being healthy, livable cities, so such regulations (with support) put us all on even footing."

What are some tools that can be used to incentivize and accelerate the replacement of lead pipes?

During Water Canada's and ReNew Canada's Lead Roundtable, one of the suggestions brought forward by multiple attendees was to have a role for insurance companies—they could offer a discount on premiums if homeowners replace the lead pipes in their homes.

"The simple example I can think of is if you put winter tires on your car, you send that information in to your insurance company, you get a reduction on your premium," said Andy Manahan,

About 20 attendees participated in the Lead Roundtable hosted by Water Canada and its sister magazine ReNew Canada in January 2020.

Credit: Water Canada

executive director of the Residential and Civil Construction Alliance of Ontario (RCCAO). "Similarly, home or health insurance companies could say 'We'd like to have a report on lead in your house. Could you give us that? If you don't have lead pipes, we'll give you a 10 per cent deduction.'"

Insurance premiums were successfully used to incentivize and accelerate the replacement of kitec pipes. The approach in that case was slightly different but it provided an example where the insurance sector played an important role in incentivizing the replacement of pipes.

"Thousands of condominiums in Toronto were equipped with kitec pipes, which have a risk of failure, in their plumbing," said Nick Reid, executive director of Ryerson Urban Water. "They were installed between 1995 and 2005 and had a 12-year life before they are expected to fail. If a condo had kitech plumbing, property owners could be faced with up to a $20,000 insurance deductible for a flood. That's the incentive that all these condominium owners had to replace the kitech."

At the same time, this approach raises questions about equity. What would happen if and when property owners can't replace pipe because of an inability to pay? How do you address the health equity?

"Replacing kitech in a one-bedroom condo costs about $5,000 dollars," Reid said. "For a three-bedroom condo, the cost is just over $10,000. If you look at condominium owners compared to detached property owners, that's proportionate to the value of their properties. To some, that's a very big hit."

What more is needed to address challenges with replacing lead pipes?

One of the things municipalities need to do is identify the lead priority areas within their communities so that priorities for replacement can be set, according to stakeholders who participated in the Lead Roundtable hosted by Water Canada and ReNew Canada. In other words, municipalities need to undertake asset management planning so that they can ensure they have the proper resources to replace all of the lead pipes in their communities.

"There's no one fix because there are different systems throughout the province," said Giovanni Cautillo, executive director of the Ontario Sewer and Watermain Construction Association (OSWCA). "I think we need to give options, and different degrees of options, depending on how severe the situation is in a particular municipality."

"One approach could be to have municipalities develop a short-term solution and a long-term solution, which is very similar to what the City of Toronto did," Cautillo added. "We need to make sure that municipalities have an asset management plan in place and make it so that municipalities can tell their constituents that they're going to address high-risk items in the short-term and the remaining items in the long-term to eliminate lead."

Effective communication, particularly with customers, was also identified as an important factor in ensuring the lead pipe replacement programs are a success.

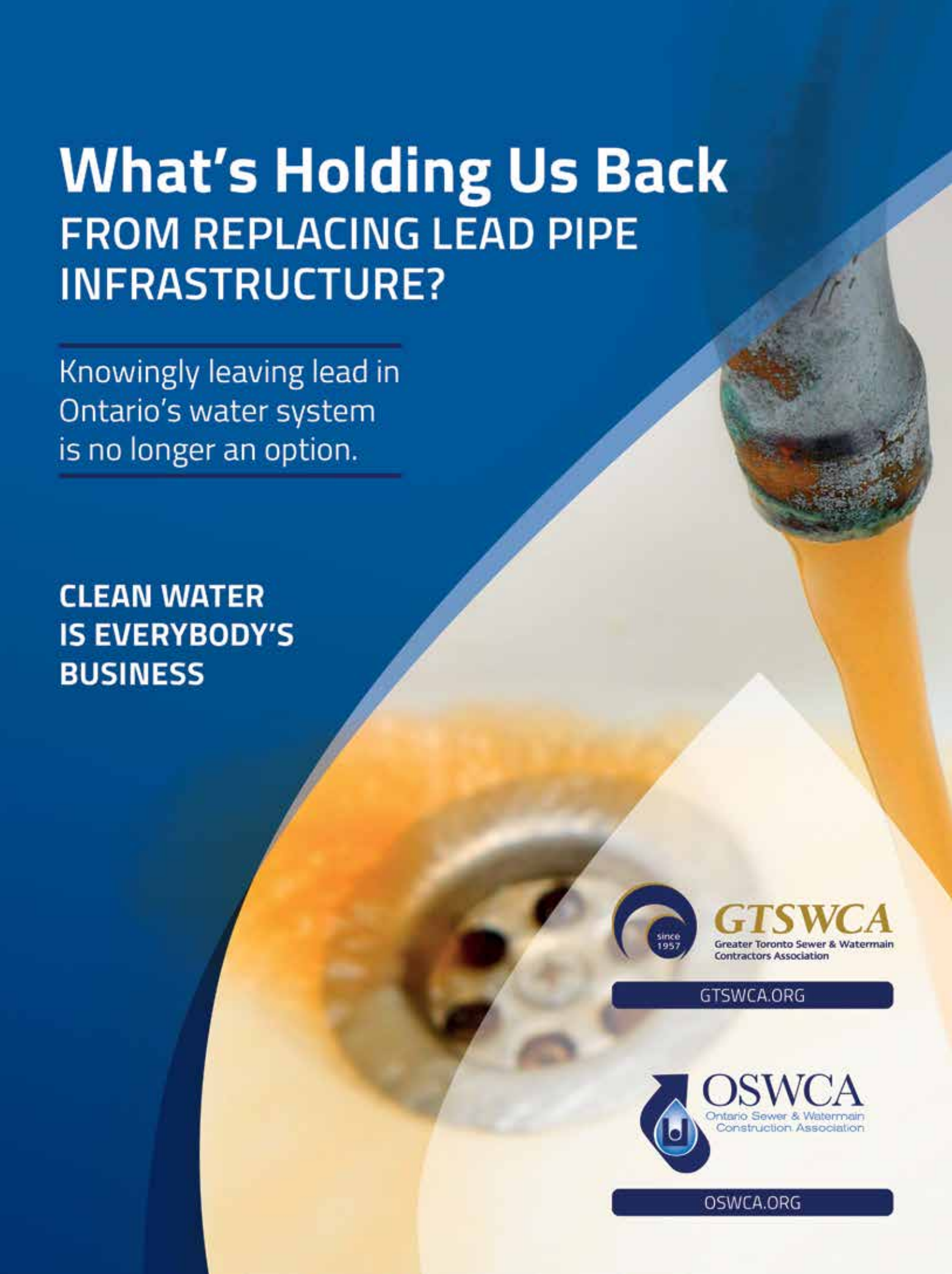
"I think a key thing that's currently missing is communication with the customer," said Stephen Craik, director of quality assurance and environment at EPCOR Water Canada. "Communication is very, very, very important. Customers don't like to learn that they and their kids have been living in a home with a lead service line when they when they weren't aware of it. That's bad news for the customer and bad news for the utility. Identifying where the lead service lines are and communicating with the residents is an important part of the process." WC

Simran Chattha is the associate editor of Water Canada.

What's Holding Us Back
FROM REPLACING LEAD PIPE INFRASTRUCTURE?

Knowingly leaving lead in Ontario's water system is no longer an option.

CLEAN WATER IS EVERYBODY'S BUSINESS



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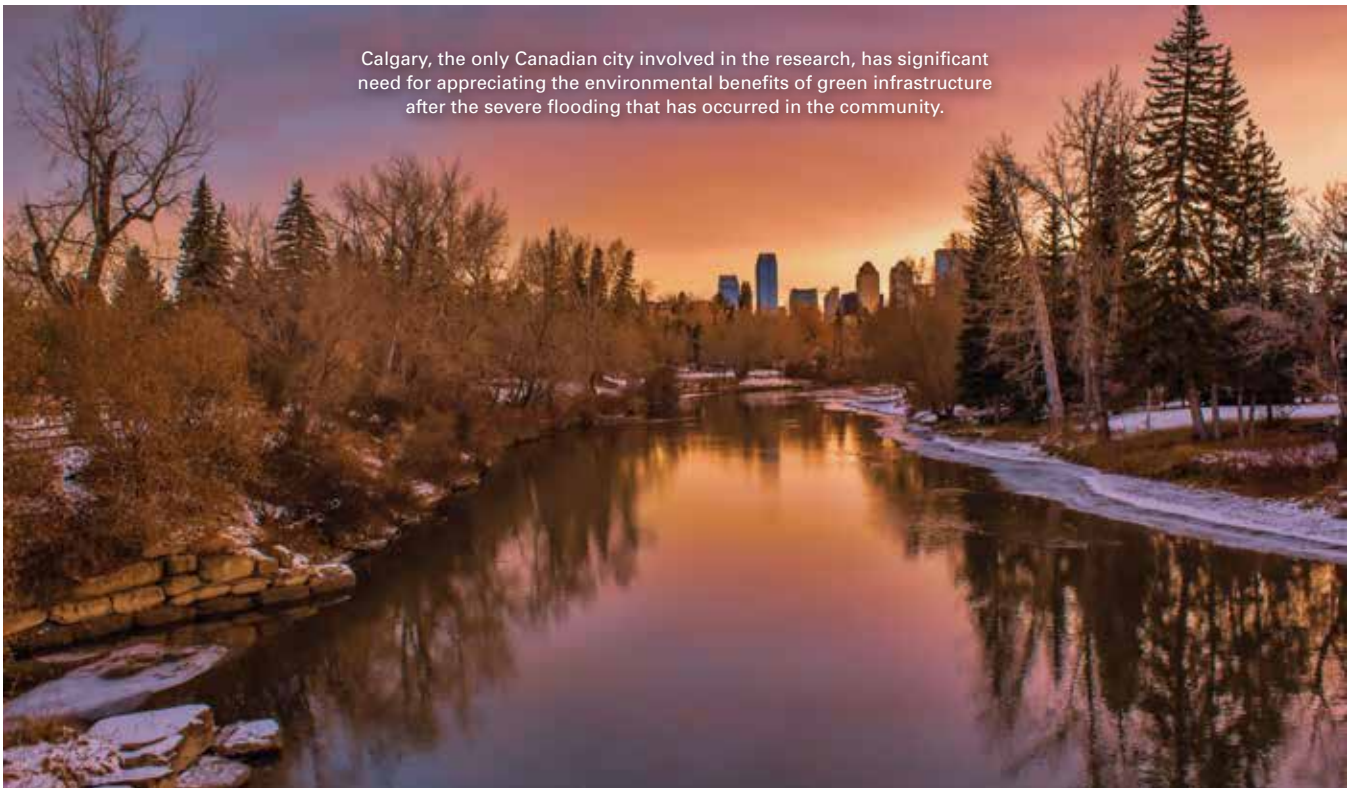


Calgary, the only Canadian city involved in the research, has significant need for appreciating the environmental benefits of green infrastructure after the severe flooding that has occurred in the community.

Valuing Green Benefits

Quantifying and monetizing green infrastructure using the triple bottom line.

BY KELSEY BEVERIDGE

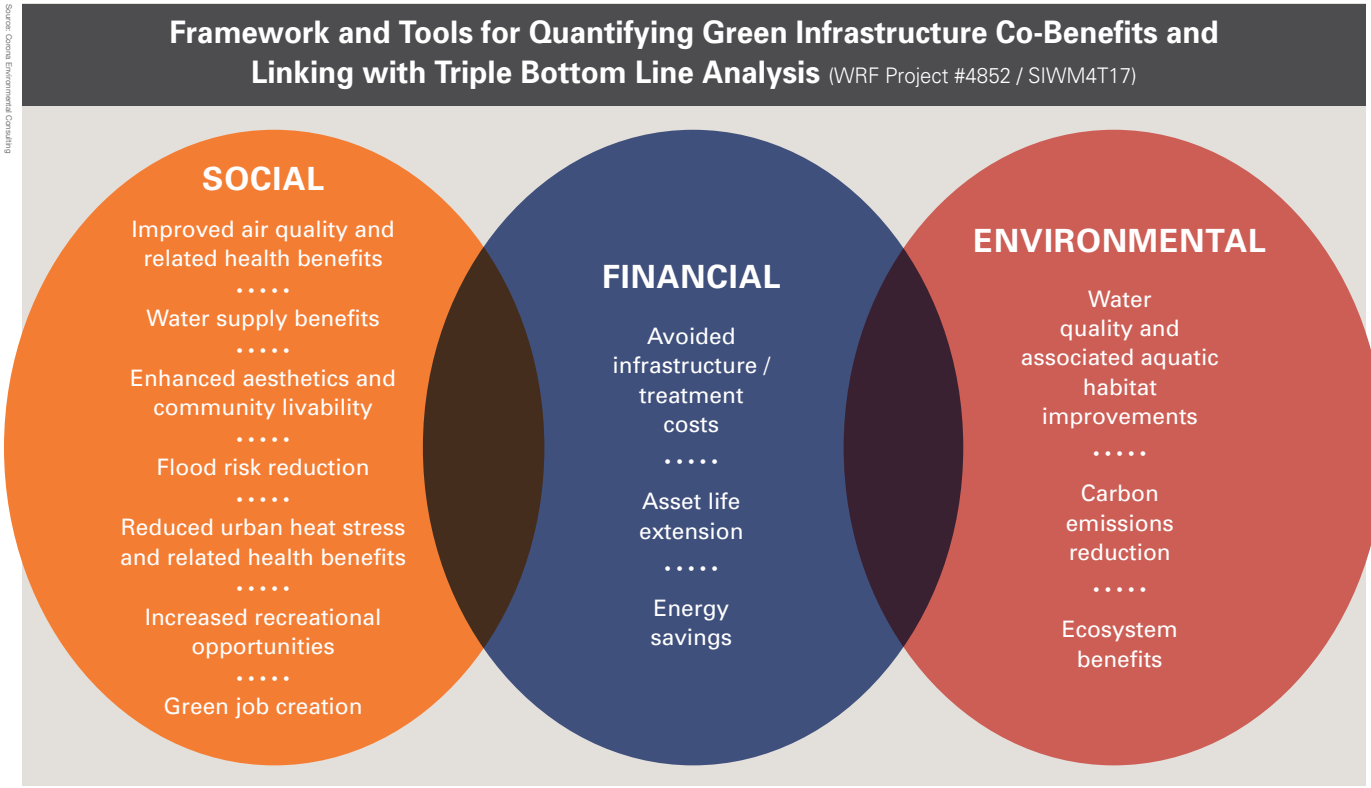
COMMUNITIES THROUGHOUT NORTH AMERICA are adopting green infrastructure (GI) programs to improve water quality and maximize the value of their infrastructure investments. GI can be a cost-effective approach to meet changing water quality standards while providing other environmental, economic, and community benefits.

As more cities and municipalities are adopting GI into stormwater management or expanding existing GI efforts, utilities have expressed a need for more information to better quantify and monetize GI benefits through a triple bottom line (TBL) approach.

GI co-benefits are generally categorized as water quality and quantity, ecosystems, energy saving, climate resilience, and community benefits. Many municipalities are looking to encourage developers to go beyond minimum requirements, as well as promote the installation of GI retrofits at existing sites. The Water Research Foundation (WRF) is leading an effort to develop a framework and supporting tool to evaluate the economic, environmental/ecological, and social values of GI.

WRF has more than 30 years of experience in stormwater and pioneering research to assess green and gray infrastructure options. An upcoming WRF project, Framework and Tools for Quantifying Green Infrastructure and Linking TBL Analysis, focuses on helping communities identify stormwater management alternatives that maximize community value, compete for scarce funding, leverage private capital and alternative funding sources, and get community support and buy-in. The research team brings together a range of perspectives with case studies and practical guidance to help utility and municipal stormwater practitioners recognize the range of alternative GI program and incentive mechanisms. This green infrastructure co-benefits study incorporates innovative approaches with proven cost-benefit methodologies to develop a quantitative framework and tool for evaluating co-benefits of GI at the community level.

The framework and tool will guide users through a series of questions to obtain the different information and inputs required. The user will input a city, neighborhood, or watershed-wide GI implementation scenario that includes a mix of GI best management practices that will help meet water quality goals. GI can be used with traditional gray infrastructure to reduce costs of stormwater management, and meet standards related to combined



Source: Cocona Environmental Consulting

sewer overflows, polluted runoff from municipal separate storm systems, and total maximum daily load targets, while also yielding co-benefits.

The project will help users identify applicable benefit categories for their GI program alternatives based on the type of program they plan to implement, the scale of the program, and other community factors, and guide users in identifying the full lifecycle costs of their GI projects/programs.

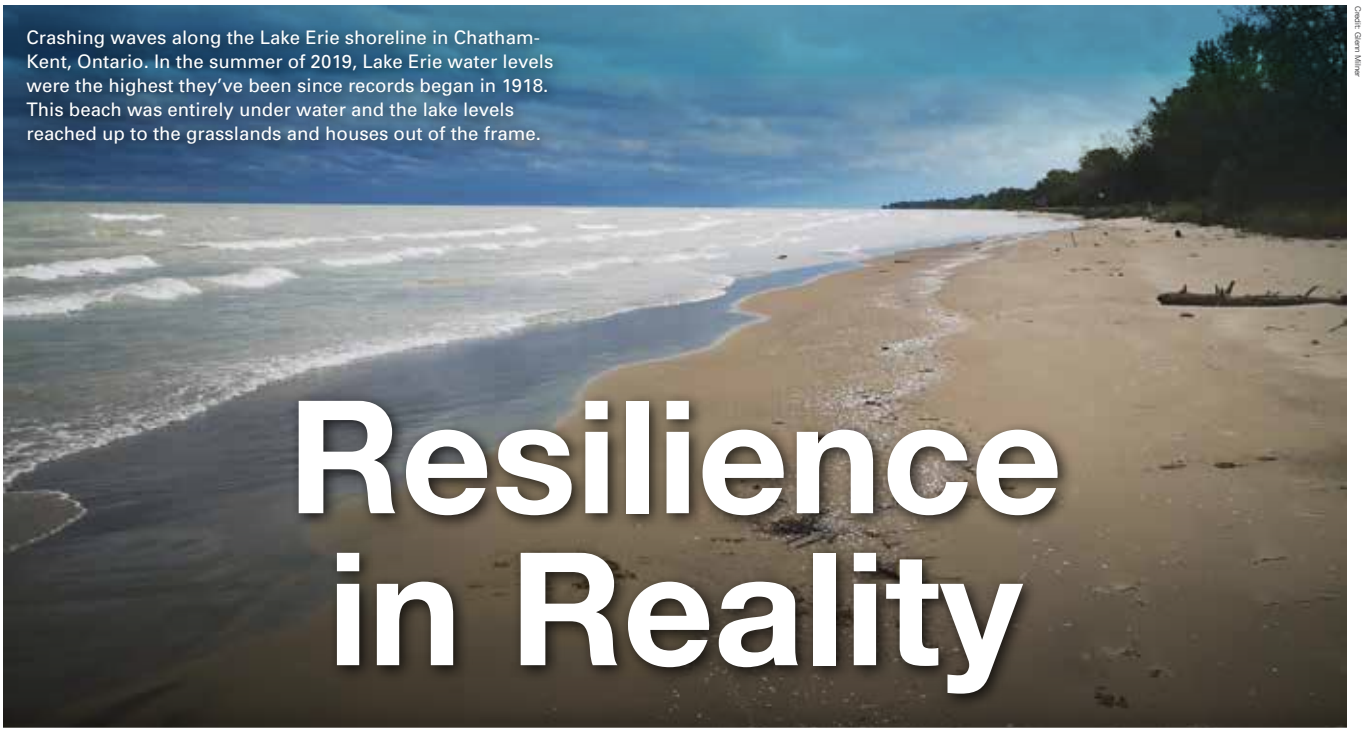
This project was developed in response to an expressed need to help utilities conduct analyses of their GI programs and develop a systematic approach to quantify and monetize the TBL benefits. An in-person utility workshop and several webinars from 2018 to 2020, hosted by WRF and the research team, sought to obtain input from participants to help influence the development of the GI co-benefits framework and tool. Participants included utilities from across the U.S., as well as the City of Calgary. Additionally, the workshop focused on different benefit categories that the project team proposed in the tool, which the participants / users can rank them by importance. Based on the inputs from the utility workshop, the highly ranked benefit categories included flood reduction, water quality, ecosystem benefits, public health, and green job creation.

Flood reduction was ranked very high because there is little data to show how GI reduces flood-related damages or how it defers costs associated with larger-scale flood reduction projects; the framework could help address this knowledge gap by allowing users to input information where the objective is to reduce flood risk and improve drainage system. In addition to addressing flood risk reduction, the tool also allows users to monetize water quality benefits based on estimates of household willingness to pay for improved water quality in local rivers and streams.

The utility workshop and webinars identified several key considerations to be incorporated into the framework and tool, and ultimately how to develop useful outputs and guidance. For example, utility participants reported that a key use of the tool will be to convince project managers and internal staff that GI is worth the effort and investment, as well as gain buy-in from municipal departments and public agencies. Many also agreed that the TBL tool will provide useful information to further public support at the community level and create a public demand for GI. The discussion reflected a need for a user-friendly tool that allows for flexibility and customization, and that helps users quantify and monetize co-benefits associated with a citywide plan. The tool can demonstrate how GI improves a utility's bottom line and the cost-benefit analysis, and can support these projects by providing data-driven, realistic estimates of how GI projects can be impactful.

Support from the 16 participating municipalities in North America helped facilitate the use of the GI co-benefits framework and tool through a national network of utilities. The participants expressed the importance that the tool remains a "living tool" with updated data and information. Ultimately, this quantification methodology for GI co-benefits facilitates the lifecycle cost analysis of stormwater infrastructure to encourage better decision making while also supporting the needs of the surrounding community. WC

Kelsey Beveridge is a technical writer at the Water Research Foundation.



Crashing waves along the Lake Erie shoreline in Chatham-Kent, Ontario. In the summer of 2019, Lake Erie water levels were the highest they've been since records began in 1918. This beach was entirely under water and the lake levels reached up to the grasslands and houses out of the frame.

Credit: Glenn Milner

Resilience in Reality

Glenn pictured facilitating a training workshop on climate change model projections and risk assessment at the Ontario Science Centre the spring of 2017. Applying future climate scenarios to support practical decision making is critical for infrastructure owners, managers, and operators across all scales and sectors.

Credit: Simran Chattha

Scaling up our response to extreme weather.

BY GLENN MILNER

THE CONCEPT OF SCALE has always fascinated me. As a child, I used to gaze out along the vast shorelines of the Great Lakes and think about how the water I was seeing crash across the beach was shared and circulated from our American neighbours in the south. As I grew up, I studied systemic environmental challenges, and looked at how we can engineer solutions for the water that flows across municipal boundaries beneath our feet. Today, I'm tackling climate change by helping communities, organizations, and decision makers prepare for and respond to extreme weather.

Indeed, the impacts of climate change are already being felt across the Great Lakes and across Canada, and we can expect these to continue and worsen regardless of how much greenhouse gas emissions are reduced through mitigation efforts. Temperatures are rising and our country is warming faster than many other parts of the world. Our precipitation patterns are more and more variable, with extreme rainfall and flooding occurring in some areas and increased dry conditions in others.

Shorter winters, earlier snowmelt, less ice cover on lakes and rivers, and changing water quality and flows are all projected and in store depending upon where you live in Canada. While it may be challenging to state that one extreme weather event was caused by

Assessing the condition and performance of existing infrastructure—and how that infrastructure may affect broader systems like our lakes, rivers, and oceans—is critical to addressing climate change.

climate change directly, science has now proven that the warming temperatures increase the potential for more extreme and variable weather and the longer we wait to adapt, the more costly it will be.

However, there is hope. There has been a rallying call to tackle climate change in the last decade. During this time, the concepts behind the words climate action, adaptation, and resilience have grown to become more generalized in support of a more resilient future. A resilient future is one where we not only are prepared and can bounce back from extreme weather and climate disruptions, but also one that is equitable across Canada, that prioritizes disproportionately affected people, and where we fully recognize and live the values of sustainability.

Scaling up adaptation planning for resilient infrastructure

A shift is on the horizon across Canada, and indeed North America, as decision makers and those that own, operate, and manage our infrastructure systems act on climate change. Decision makers are recognizing the importance of moving from research and planning to prioritizing, investing, and implementing resilience in a practical sense. Those that have undertaken research, risk assessments, and analysis to inform priorities are now developing business cases to obtain funding. Those that have already designed and constructed to higher standards and with resilience in mind are monitoring and evaluating how they are performing for continuous improvement.

As these climate adaptation efforts continue to expand and become common practice, let us return to the concept of scale. We cannot afford to nor wait for each community, organization, and decision maker to tackle it alone. It is crucial that neighbouring organizations and communities consider planning towards similar futures. Consistency between communities, shared resources between infrastructure owners and operators, interdisciplinary training, and communication between those who know their systems best are all paramount as we tackle an uncertain future without breaking the bank.

What specifically do we mean when we say we are investing in a resilient infrastructure system? How can we practically break down these concepts and implement straightforward actions to respond to a more extreme Canada? What needs to happen to scale up adaptation efforts so that the benefits can be realized at the regional, provincial, and national scales? WC

Glenn Milner is a climate change adaptation and resilience specialist with Savanta.

Canada's 10 LARGEST Water Infrastructure Projects

Top100 Canada's Biggest Infrastructure Projects

The annual Top100 Projects list is available for free online at top100projects.ca

EACH YEAR, our sister publication ReNew Canada provides its report on the largest public sector infrastructure projects in Canada. This year's report reached new heights, with over $240.8 billion in assets in the transit, transportation, energy, health care, water, and other public sector projects making the list, with nine of the 13 provinces and territories represented.

The water sector continues to have a strong presence on the list, with nine of Canada's Top100 Projects coming specifically from the water sector. That includes wastewater treatment plants, reservoirs, and flood mitigation assets in four Canadian provinces (B.C., Alberta, Manitoba, and Ontario). One additional project, which appeared in this space last year, just missed the Top100 cutoff, but since it registers well over $300 million, we have included an update on it as well.

For each project on this list, we have provided information on cost, funding, companies involved in all aspects of the project delivery, basic project specifications, and an update on the progress that has been made in either procurement or construction.

For more information about any of these projects, visit **top100projects.ca** or visit our website at **watercanada.net** for the latest news.

1

Don River and Central Waterfront Wet Weather Flow System & Connected Projects

$2 billion

Top100 Projects 2020 Rank: 28

Location: Toronto, Ontario

Owner: City of Toronto

Contractor: Graham

Engineer: Morrison Hershfield; AECOM; Wood

Other Key Players: Golder; Rider Levett Bucknall; The Walsh Group; DECAST

Funding: Public

Credit: ElliaDon

The Don River and Central Waterfront Wet Wester Flow System & connected Projects is a 25-year program aimed at improving water quality in Toronto's Lower Don River, Taylor-Massey Creek, and the Inner Harbour.

In August, Toronto City Council endorsed a plan to reach out to both the provincial and federal governments for funding assistance for the project, funding that would allow for the project to be completed up to eight years ahead of its current schedule.

The Coxwell Bypass Tunnel, as well as the integrated pumping station at the Ashbridges Bay Wastewater Treatment Plant, and new outfall at the plant, are among the first projects to be undertaken as part of the overall program. Construction of the tunnel is underway now, and is scheduled for completion in 2023. The station project is anticipated to be completed by 2026, and the new outfall by 2025.

2

North End Sewage Treatment Plant Biological Nutrient Removal Upgrade

$1.789 billion

Top100 Projects 2020 Rank: 35

Location: Winnipeg, Manitoba

Owner: City of Winnipeg

Engineer: AECOM (owner's advocate/ consultant); KGS Group Ltd.

Legal: Blake, Cassels & Graydon

Other Key Players: Hanscomb (independent/engineer's design stage cost consultant); Veolia (professional services); P1 Consulting Ltd.

Funding: Public

- **Provincial:** $195 million
- **Municipal:** $1.594 billion

Credit: City of Winnipeg

The Government of Manitoba has issued the City of Winnipeg an Environment Act Licence, which requires the treatment of nutrients (such as nitrogen and phosphorus) among other requirements at this treatment facility. The implementation of a nutrient-removal process will require a major plant expansion and, given the age of the infrastructure and the complexity of phasing the construction, several new facilities will be constructed. The addition of wet weather treatment processes associated with combined sewer overflow control must be considered in the overall nutrient-removal process design and operational effluent disinfection for wet weather. In February 2019, Winnipeg City Council approved a request to break the overall project into three separate capital projects: North End Sewage Treatment Plant Upgrades: Power Supply & Headworks Facilities, $408 million; North End Sewage Treatment Plant Upgrades: Biosolids Facilities, $553 million; North End Sewage Treatment Plant Upgrades: Nutrient Removal Facilities, $828 million.

3 Port Lands Flood Protection and Enabling Infrastructure

$1.25 billion

Top100 Projects 2020 Rank: 47

Location: Toronto, Ontario

Owner: City of Toronto

Project Manager: Waterfront Toronto; City of Toronto

Construction Manager: EllisDon

Contractor: EllisDon (Cherry Street Lakefilling Project)

Engineer: Wood (consulting)

Architect: Michael Van Valkenburgh Associates Inc. (Port Lands Estuary Plan)

Environmental Services: Arcadis Canada

Other Key Players: MVVA (design of parks, flood protection, rover valley); WSP and DTAH (roads and municipal infrastructure); Entuitive with Grimshaw and SBP (bridges); Jacobs (environmental); Toronto Region Conservation Authority; Golder; INTECH Risk Management; Dillon Consulting (planning services); GHD (geotechnical and environmental services); A.W. Hooker (cost consultant); Englobe

Funding: Public
The federal, provincial, and municipal governments are each contributing an equal share of $416.6 million to this project.

Credit: Waterfront Toronto

The Port Lands Flood Protection and Enabling Infrastructure project is the redevelopment of one of the largest portions of underdeveloped land in a major urban core in North America. Located along the shore of Lake Ontario southeast of Toronto's downtown core, the project will include substantial soil remediation, a new mouth for the Don River, and critical infrastructure for flood resilience to unlock the 325-hectare site for residential and commercial development. In January 2018, work began on the Cherry Street Stormwater and Lakefilling project. The project will stabilize the shoreline under flood conditions, enhancing aquatic habitat, and allow for the realignment of Cherry Street. Work on this section of the project is expected to be completed by March 2020.

4 Capital Region District Wastewater Treatment Plant

$775 million

Top100 Projects 2020 Rank: 63

Location: Victoria, British Columbia

Owner: Capital Region District

DBF Team: Harbour Resource Partners (McLoughlin Point Wastewater Treatment Plant)—AECOM Canada; Graham; SUEZ; CEI; Gracorp; Michelss Canada

DBFOM Team: Hartland Resource Management Group (Residuals Treatment Facility)— Bird Construction; Maple Reinders; Synargo Capital

Contractor: Kenaidan Contracting Ltd. (Clover Point Pump Station)

Management Consultants: EY

Legal: Norton Rose Fulbright (advisor to CRD); Bennett Jones (counsel); Borden Ladner Gervais

Other Key Players: KPMG (commercial advisor); Operis (financial advisor for RTF team); Aon; Associated Engineering; Kerr Wood Leidal; Stantec; Parsons (Residual Solids Pipeline Phase – Designer); GHD (odour control & HVAC); Deloitte; INTECH Risk Management

Funding: P3

Credit: CRD

The Capital Regional District's Wastewater Treatment Project will provide tertiary treatment for wastewater from the core area municipalities of Victoria, Esquimalt, Saanich, Oak Bay, View Royal, Langford and Colwood, and the Esquimalt and Songhees Nations. The project consists of three main components: the McLoughlin Point Wastewater Treatment Plant, which will provide tertiary treatment to the core area's wastewater; the Residuals Treatment Facility which will turn the residual solids into Class A biosolids; and the conveyance system which is the pumps and pipes that will carry wastewater from across the core area to the treatment plant and residual solids to the Residuals Treatment Facility. In May, the CRD board approved a project budget increase of $10 million, after a staff report concluded that the project could not be built for the original budget. In 2018, the Residuals Treatment Facility began construction, along with the major parts of the conveyance system. The remaining aspects of the conveyance system began construction in 2019. All of the project components are scheduled for completion by the end of 2020.

5 North Shore Wastewater Treatment Plant

$700 million

Top100 Projects 2020 Rank: 68

Location: North Vancouver, British Columbia

Owner: Metro Vancouver

DB(F) Team: ADAPT Consortium—Acciona Infrastructure; DIALOG; Wood; TetraTech

Engineer: AECOM (owner's engineer); Wood (consulting)

Consulting Architect: Miller Hull; HDR/CEI

Legal: Norton Rose Fulbright (counsel for Metro Vancouver); Osler (DBF Counsel); Torys (acted for lender)

Other Key Players: Space2Place (public consultation, research and analysis, concept development); BTY Group (cost consultant); Golder (geotechnical evaluations); Maple Reinders (compatibility advisor); KPMG (business case financial advisor); Pomerleau; Aon; WSP (procurement); INTECH Risk Management; Deloitte (financial and procurement advisor)

Funding: P3

Credit: Acciona

This greenfield secondary treatment plant will replace an existing primary treatment plant. New federal and provincial regulations require the upgrade of all primary treatment plants. The existing primary plant removes only 40 to 60 per cent of suspended organic matter in the wastewater, which, after primary treatment, is discharged directly into Burrard Inlet—a matter of concern for some environmentalists—and is located on land leased from the Squamish Nation. The new secondary plant will be able to remove over 90 per cent of organic matter and will be located two kilometres east of the existing plant. Increased plant capacity will allow up to 320 million litres per day to be treated under storm conditions. Construction officially began in late August 2018. The new plant is scheduled to be operational by the end of 2020, and the existing primary plant will be de-constructed once the new plant is in service.

6 Bonnybrook Wastewater Treatment Plant D Expansion

$600 million

Top100 Projects 2020 Rank: 77

Location: Calgary, Alberta

Owner: City of Calgary

Project/Construction Manager: Graham

Contractor: KLS Earthworks & Environmental (Bonnybrook emergency outfall channel)

Engineer: Stantec (local); Jacobs; AECOM; Wood (consulting)

Legal: Blake, Cassels & Graydon (advised the City of Calgary)

Other Key Players: Hanscomb (owner's design stage cost consultant); Aon (owner advisor and construction insurance broker); WPC Water Solutions; AGAT Labs; McElhanney (mgmt. services)

Funding: Public

Credit: Acciona

One of Calgary's three wastewater treatment plants, Bonnybrook is undergoing an expansion with the plant estimated to be able to service an additional equivalent population of 325,000 people. When construction is completed in 2022, the facility will service a population of 1.366 million people. The Plant D expansion is the largest project of the overall upgrade and includes new primary and secondary clarifiers, new bioreactors with biological nutrient removal system, new treated effluent filtration facility, new Thermal Hydrolysis Process facility, and a new flood berm. The City is also upgrading the existing ultraviolet disinfection system, digesters, and primary sludge thickening systems. Three significant construction projects got underway in 2019: the primary treatment expansion, new biogas storage facility, and the cogeneration facility expansion. Work was also done on the emergency outfall channel.

7 Annacis Island Wastewater Treatment Plant Expansion

$550 million

Top100 Projects 2020 Rank: 82

Location: Delta, British Columbia

Owner: Metro Vancouver

Construction Manager: Graham/Aecon Joint Venture (Stage 5 expansion); Hatch (outfall project)

Contractor: North American Construction; Kenaidan Contracting (computer control system and laboratory building); Bessac/Pomerleau JV (outfall pipeline)

Engineer: Brown and Caldwell, Stantec, EIC Solutions, Klohn Crippen Berger (Stage 5 Expansion); CDM Smith, Golder (outfall); Wood, Black & Veatch (Cogeneration Backup Power)

Legal: Norton Rose Fulbright (for Metro Vancouver)

Other Key Players: EXP (vibration monitoring); JJM Construction and Geopac Inc. (prepare the ground and relocate utilities); Golder (outfall design team); WSP (materials engineering and testing); Hatch (tunnel design review and outfall construction management); Colliers Project Leaders; Jacobs (construction mgmt. services); McElhanney (surveying services); Aon

Funding: Public

Credit: Graham

When this Stage 5 project by Metro Vancouver is complete, the Annacis Island facility will serve 1.5 million people in 14 Metro Vancouver municipalities. Today, it serves 1.25 million people. The previous expansion, Stage 4, was done in the late 1990s. The plant serves much of the Tri-Cities, Burnaby, Maple Ridge, Delta, Surrey, Pitt Meadows, Langley, and White Rock. The $184-million contract for the outfall pipeline was awarded in September. The outfall pipe will be excavated using a tunnel boring machine. Construction is scheduled for completion in 2022.

8 Lake Manitoba and Lake St. Martin Outlet Channels

$540 million

Top100 Projects 2020 Rank: 83

Location: Interlake, Manitoba

Owner: Government of Manitoba

Contractor: 513 Construction Ltd./Glen Hartman Construction Ltd. (all-weather road construction); Interlake Regional Tribal Council/Sigfusson Northern Ltd. (all-weather road construction)

Engineer: Hatch; KGS Group

Environmental Services: North/South Consultants Inc.; M. Forster Enterprises; Stantec; E. Hicks & Associates Ltd.; Szwaluk Environmental Consulting Ltd.; Magellanicum Ecological Services

Funding: Public

- Federal: $247.5 million
- Provincial: $292.5 million

In 2011, southern Manitoba experienced widespread flooding and Lake Manitoba experienced excessively high inflows through the Waterhen River, Whitemud River, and the Portage Diversion. This flood protection project is intended to improve lake level regulation and consequently reduce the likelihood of flooding along Lakes Manitoba and St. Martin. The $540-million flood protection project consists of two 23-kilometre long outlet channels with associated control structures and bridge crossings as well as an 80-kilometre all-weather access road and a 24kV transmission line to the Lake St. Martin outlet channel control structure. The Lake Manitoba outlet channel will connect Watchorn Bay on Lake Manitoba to Birch Bay on Lake St. Martin and the Lake St. Martin outlet channel will drain Lake St. Martin from a point in the southeast to Willow Point in Lake Winnipeg. Two sections of the all-weather access road are currently under construction, with an anticipated completion in 2019. Outlet Channel construction is scheduled to commence in 2020. Manitoba recognizes its duty to consult with Indigenous peoples in a meaningful way. The engagement and consultation process is currently underway, with 31 Indigenous communities identified as having the potential to be affected by the project.

Photos: Government of Alberta

9 Springbank Off-stream Reservoir

$432 million

Top100 Projects 2020 Rank: 97

Location: Calgary, Alberta

Owner: Government of Alberta

Engineer: Stantec

Environmental Services: Stantec

Legal: McLennan Ross (Counsel for the Government of Alberta)

Funding: Public

The Springbank Off-stream Reservoir represents the Government of Alberta's solution to mitigate severe flooding along the Elbow River, similar to what took place in June 2013. Current plans call for a dry reservoir with a capacity of 70.2 million cubic metres, with an outlet structure to safely release the water back to the river when safe to do so. The reservoir will be located approximately 15 kilometres west of the City of Calgary. The Government of Alberta, under Premier Jason Kenney, hired lawyer Martin Ignesiak in May to explore ways to expedite the project. However, in July, the Tsuut'ina Nation Council voted to formally oppose the project, citing environmental impact concerns including the potential for groundwater pollution. This opposition is likely to delay the project's original anticipated completion date. Construction will require three years, with the reservoir being functionally operational at a reduced level after two years.

10 Woodward Wastewater Treatment Plant

$340 million

Top100 Projects 2020 Rank: 103

Location: Hamilton, Ontario

Owner: City of Hamilton

Contractor: Maple/Ball JV, a joint venture between Maple Reinders and Ball Construction (Raw Sewage Pumping Station); Alberici Contractors (Electrical and Chlorination System Upgrades)

Other Key Players: CIMA+; Jacobs (design and project mgmt.)

Legal: Blake, Cassels & Graydon (advised the City of Hamilton)

Funding: Public

Credit: City of Hamilton

The Woodward Wastewater Treatment Plant project is one of several measures being implemented to address concerns over the quality of the water in Hamilton Harbour. This multi-stage project will have a direct impact on the health of the local enviroment, specifically the water quality in the harbour.

The project includes: new raw sewage pumping station; new energy centre/electrical upgrades; the addition of a tertiary level of treatment; new chlorine contact tank; upgrades to the Red Hill Creek outfall; and upgrades to the collection system.

As of September 2019, 40 per cent of the work had been completed on the raw sewage pumping station, including the first two levels of the service structure. Electrical upgrades were 60 per cent completed, and the tertiary treatment work was underway. The entire project is scheduled for completion in 2022.

Winter condition testing.

Inset: Mobile unit set-up.

Photos: HydraTek

Leakage Reduction

Water loss management project helps reduce energy consumption associated with leakage.

BY BRADLEY JENKS AND FABIAN PAPA

IN APPRECIATION OF the connection between water supply and energy use, and more particularly the needless energy consumption associated with leakage, the Independent Electricity System Operator (IESO) is supporting a multi-year (2019 to 2021) water loss management project through its Grid Innovation Fund. This cross-sectoral project is being led by HydraTek & Associates in collaboration with the National Research Council, the Ontario Water Works Association, the University of Toronto, and several municipalities. The principal objectives of the project are to:

1. Develop a cost-effective tool to accurately and reliably measure minimum night flow (MNF) into sectors of water distribution systems, often referred to as district metered areas (DMAs).
2. Derive meaningful MNF benchmarking metrics to represent "healthy" systems and from which potential recoverable leakage can be calculated on a relative basis, thereby assessing DMA performance.
3. Directly test and report the effectiveness of pressure reduction on leakage reduction.

This article discusses the connection between leakage and energy consumption, the development and application of a mobile testing unit, and associated evidence-based benchmarking metrics. It also highlights some interesting findings from interim testing results achieved as at the time of writing this article.

Synergy between leakage and energy consumption

Apart from the relatively few water distribution systems (WDSs) that utilize gravity supply, pumping energy represents the largest form of energy consumption in system operations. In addition to treatment processes (embedded energy in chemical and physical operations), pumping energy is required to:

1. Overcome elevation differences between the supply and point-of-use.
2. Provide an adequate service pressure to consumers.
3. Overcome energy losses that spawn from frictional resistance as water is moved through piping networks.

Furthermore, pumps are fraught with inefficiencies where an average wire-to-water energy loss of 30 per cent is not uncommon in Ontario WDSs [1]. Accordingly, significant investments in terms of both financial and natural resources are required on an ongoing basis for the provision of potable water to service communities. In an increasingly resource-constrained environment, it is therefore important to confront the waste of such fundamental natural resources as water and energy. Efforts to reduce system flow, such as leakage, are directly proportional to the reduction of required power consumption, yielding both financial and environmental benefits.

Mobile testing unit

Inspired by previous work of the National Research Council and the City of Ottawa, HydraTek has developed a mobile testing unit designed to affordably capture flow characteristics into DMAs. More specifically, it is designed to accurately and reliably capture the lowest of flows which occur overnight; known in the industry as minimum night flows (MNFs). Analyses involving the MNF can be valuable indicators of potential leakage as it represents an instance in the system where leakage constitutes the highest fraction of total flow. Consequently, performance metrics can be developed where MNF is normalized against various system characteristics (e.g., number of connections, length of main, average consumption, among others) to derive benchmarks and make comparisons. Performance metrics can also be developed to help identify poor performing systems where increased investment in leak detection and repair may be warranted.

Temporary DMA monitoring solutions—often insertion-type electromagnetic flow meters and, less often, clamp-on ultrasonic flow meters—are commonly employed as an affordable and logical initial step to test system performance. However, these solutions may sometimes not be able to provide accurate and reliable low flow measurements. This issue typically arises as a result of the relatively low overnight flow velocities

Figures: Source: HydraTek

FIGURE 1

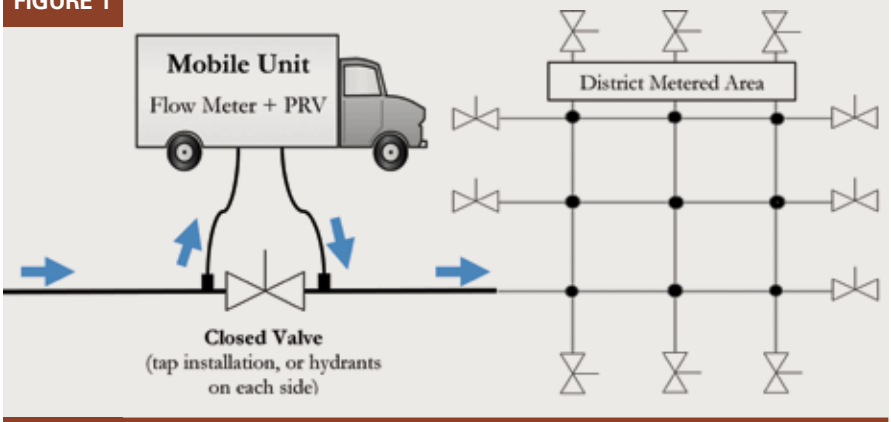
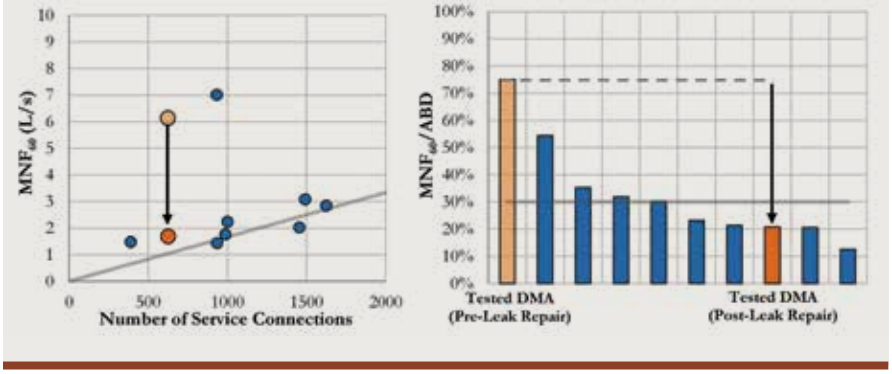


FIGURE 2



in watermains whose sizing is largely dominated by fire flows which can be more than two orders of magnitude higher than domestic nighttime flows. Accordingly, as DMAs become smaller in size, reliable data becomes increasingly difficult to obtain using these methods. The mobile testing unit overcomes this issue by processing flow through an in-line flow meter and serves the function of what would normally be a far more costly permanent installation of an in-line meter and chamber in the distribution system (Figure 1).

In addition to flow measurement, a key feature of the mobile testing unit is its ability to directly test the effectiveness of pressure reduction on reducing leakage. Rather than relying on empirical "rule-of-thumb" pressure-leakage relationships, the mobile testing unit houses a pressure reducing valve (PRV) that is used to derive a unique data-driven (evidence) relationship for each DMA test site. This capability is not available with the other temporary monitoring approaches discussed above, and eliminates the intrinsic uncertainty associated with the benefits of pressure reduction and, more generally, promotes evidence-based decision making.

Interim project results

The mobile testing unit was assembled in April 2019 and has since been deployed at seven of the project's 20 allotted DMA sites. Project activities at each site consist of workshops to outline the study's methodology, provide field-specific preparation details, and present results. Testing is done over multiple nights both at full pressure to capture MNF information and at reduced pressure settings. This is used to provide site-specific reporting and recommendations. The measured MNF60—a 60-minute averaging period used to eliminate random uncertainty in the data—relative to certain key DMA characteristics, such as the number of service connections and the average billed demand (ABD), are used to populate meaningful benchmarking metrics as displayed in Figure 2. Although the current benchmarking metrics are under development and subject to change as additional data is collected, initial results have been very promising.

One of these DMAs is not like the others

Quite importantly, Figure 2 illustrates the results of a particular test site (light orange) that shows a pronounced departure from the generated MNF benchmarking frontier which represents DMA's that have been determined to have insignificant leakage (i.e., healthy systems). Evidently, this suggested that a significant amount of leakage was present. In turn, the municipality engaged in leak detection efforts, resulting in the location and repair of a substantial leak. Shortly thereafter, post-intervention testing was conducted and the processed results (dark orange) revealed the DMA performing in the region of its healthier peers, verifying the reduction in leakage within the DMA.

The magnitude of the leak discovered and repaired resulted in the following measured and verified beneficial (rather, exceptionally beneficial) impacts to the municipality:

- Water savings: 139,000 m3/year
- Financial savings: $426,000/year
- Energy savings: 102,000 kWh/year (102 MWh/year)
- Mitigated environmental impacts: 4.1 tonnes of CO2/year (@ 40 g CO2/kWh)

To this end, results from the Ontario-wide project contributed to not only water conservation and long-term sustainability goals in the municipality, but also in energy conservation and associated environmental factors realized by the Ontario power industry and beyond.

Additional information, including results, is available at http://hydratek.com/mobile_dma_testing. Furthermore, results of the program will be summarized in a report to be made available for public consumption subsequent to project completion in 2021, with the individual municipality results to remain anonymous. WC

Bradley Jenks is an engineering assistant at HydraTek. Fabian Papa is a director at HydraTek.

Credit: Oliver Woods

Emma Wattie played an integral in bringing DataStream to Atlantic Canada.

Credit: Kristina Fry

Emma Wattie, director of the Atlantic Water Network, was nominated for a Water's Next Award by Carolyn DuBois, the director of The Gordon Foundation's water program.

Water Steward

Emma Wattie reflects on her 2019 Water's Next Award and her work at the Atlantic Water Network.

BY SIMRAN CHATTHA

EMMA WATTIE'S LOVE FOR DATA set her up for success as the director of the Atlantic Water Network, which provides equipment and resources for water monitoring throughout Atlantic Canada.

"Emma Wattie has been instrumental in introducing a suite of supports that have transformed how water monitoring and restoration is carried out in Atlantic Canada," according to Carolyn DuBois, the director of The Gordon Foundation's water program. "Through her work with the Atlantic Water Network, Emma has built critical infrastructure and relationships that have enabled community-based monitoring initiatives to achieve greater impact both locally and regionally."

"Emma has also championed the importance of sharing water data across watersheds and jurisdictions," added DuBois. "From conception to implementation, Emma played a key role in bringing DataStream—an open access online platform—to Atlantic Canada. Her success in building a strong partnership with The Gordon Foundation and ability to mobilize community-based monitoring groups across four provinces made it possible to establish Atlantic DataStream in under one year."

For her role in transforming water monitoring and data sharing in Atlantic Canada, Wattie received the Water Steward of the Year award at the Water's Next Awards Gala in May 2019. Water Canada recently had an opportunity to catch up with Wattie and ask her a few questions.

What was it like winning the Water's Next Award in 2019?

I think it was an honour to be recognized at the Water's Next Awards last year and to be recognized from a national perspective. Winning the Water Steward of the Year award was overwhelming and exciting. I was very much left at words at the moment.

What projects and initiatives have you been involved with while working at the Atlantic Water Network?

The Atlantic Water Network is based out of Saint Mary's University and it is essentially a network of watershed organizations in Atlantic Canada.

We work with groups in all four provinces. Each of the Atlantic provinces has a great network provincially. We're the only Atlantic wide organization that brings groups from across the region together.

It's really easy for groups within each province to work together. But we've found that it's really also really easy for group not to work together when they're dealing with the same issues. I think integral that groups across the region learn from each other, hear from each other, and really have that peer-to-peer mentorship.

We also provide equipment through our Equipment Bank program. It's

Credit: Water Canada

For her role in transforming water monitoring and data sharing in Atlantic Canada, Emma Wattie received the Water Steward of the Year award at the Water's Next Awards Gala in May 2019.

our longest running program, which provides equipment that groups can use at no cost to themselves. They just have to come and pick it up. We calibrate the equipment and maintain it. With this program, groups can trust that they're still collecting high quality data but don't have the expenses associated with maintaining the equipment.

In addition to this, we provide a lot of resources for groups who are just starting out a monitoring program and asking questions about where to begin.

Of course, we also work with groups that have been around for 20, 30 years and just need some support related to data management and maintaining the situational knowledge that sometimes gets lost year to year. We provide different resources so that groups don't have to start from scratch when they have summer students every year.

The Atlantic Water Network is also the regional lead for Atlantic DataStream. DataStream is managed by The Gordon Foundation. We've been partnering with The Gordon Foundation for the last four years on really implementing DataStream and data management protocols. We've been working towards DataStream without knowing it for a long time in Atlantic Canada. Bringing DataStream to the region and has been really beneficial because a lot of groups have grown in their own capacity through having access to DataStream.

We also produce different workshops on data management and data analysis. We just had one in December 2019 on data analysis that demonstrated how to use R for analyzing data.

What types of industry trends have you observed through your work?

I think open access data really scared people five years ago. There were a lot of concerns—how do I know people are using my data for good? How do I know people are not making profit off my data? How do I know I am still going to get credit for collecting this data?

I think there are a lot fewer concerns about that now because DataStream has really done its homework in making sure data is open access, ethically. It's also made sure that people have DOI's created for each data set so that individuals using the data can cite the DOI. The data stewards can also see when their data has been used, which is really cool when you look through the DOI.

The governments have really come on board. Nova Scotia Environment as well as Environment and Climate Change Canada have data on DataStream, which is really great. We are working with the other Atlantic provinces to see if there is interest and willingness to put their data online as well.

Overall, there has been a lot more movement towards transparency. A lot of provincial governments have mandates towards open access so it aligns really well together.

What advice do you have for young professionals in the water sector? Is there something you wish you had known when you were starting out in the industry? Is there something that you might have done differently?

I would say, honestly, it's all about networking. Sometimes, it's awkward. As uncomfortable as it can be, it's really about making those connections, talking to people, and asking questions that really makes it helpful.

Even though I didn't know The Gordon Foundation very well before our first meeting four years ago, I had met Carolyn [DuBois from The Gordon Foundation] at a couple of meetings before that. I think part of the reason why our partnership has worked so well is because it wasn't totally fresh. We were both aware of each other's programming and we both knew of what was happening before there was an identified need [for the partnership].

Making connections and networking is really difficult. I know for like a lot of millennials, cold calling or talking to people in a person-to-person setting can be really uncomfortable. But by getting outside your comfort zone, you can really make the difference. WC

Simran Chattha is the associate editor of Water Canada.

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The mining industry is working to build cleaner solutions for water being discharged into the surrounding environment.

A Responsible Approach

Overcoming the mine water management challenge.

BY VALÉRIE BERTRAND

IF EVER THERE WAS an industry that put water professionals to the test, it would be mining. It demands excellence and innovation in all aspects of water management and treatment. The interplay between all aspects of a mine's operation and water cannot be understated. Whether being used in mining processes or protecting the water in the surrounding environment, water considerations must take place at every stage of a mine's life.

Canadian mines provide a range of metals and minerals essential to daily life. From the mundane, like health supplements and toothpaste, to the modern technologies of smartphones and electric car batteries, our need for these resources is clear. And our need to responsibly extract these resources in a sustainable way is more important than ever. Mining companies are focused on minimizing their impact and their footprint, and that includes the responsible use of water in their operations.

Water management plans

Responsible use of water includes implementing water management plans from the inception of the project through to closure, as an integral part of the mine design and operation. Gone are the days of thinking about closure at the end of a mine's life, we now consider closure right from project inception. It's not a matter of cleaning up water after the fact; it's about protecting it from the start. Early planning allows the mine to take advantage of natural landforms and water flows to minimize the need for treatment down the line and for efficient use of water on site.

Key elements in the responsible use of water resources include a robust water balance, which considers the influence of the various sources of flow onto and within the property and releases to the environment. An understanding of the seasonal flows is critical in the Canadian climate where a large part of surface water flow occurs in the "freshet" period of spring thaw, often followed by limited flows the rest of the year and frozen conditions over winter. Consideration of annual water use for mine operations must be understood and planned for so that the sudden onset of clean snow melt can either be diverted or contained in sufficiently large ponds. In a changing climate where freshet flows, rainfall, and storm events differ from the historical record, sensitivity analysis is a necessary exercise to test for and adapt to possible upset conditions. Climate change will have a strong influence on future water management procedures, discharge quantities, water treatment requirements, and effluent discharge and quality in the short and long term.

Groundwater inflows can be an additional source of water and require

management year-round, including in winter when ponds and water lines may be frozen at surface. Deep groundwaters intercepted by mining can be saline and may require specialized handling and water treatment such as a desalination plant, which can be more complex and expensive than standard water treatment plants. Failure to identify the key driving factors of the water balance increases the risk of costly last-minute adaptations, or long-term liabilities associated with capture and treatment of water.

Where waste meets water

The valuable commodities we gain from mining often constitute a small fraction of the materials extracted from the ground. What we don't use is stored in waste rock stockpiles or tailings containment facilities. Early waste management planning allows for mine infrastructure to be designed for optimal storage conditions of wastes in relation to water bodies, to minimize water management and treatment needs.

> Early planning allows the mine to take advantage of natural landforms and water flows to minimize the need for treatment down the line.

Understanding of mine waste composition and contamination potential is another key element in effective waste and water management. Water that comes into contact with these mined materials must be monitored to verify or control their quality prior to discharge back into the environment. Not all wastes release harmful contaminants, but some wastes are enriched in the metals that are being mined. Chemical constituents naturally present in the rock can have a different behaviour once rock is crushed or ground and exposed to the environment. Metals and other chemicals can dissolve on contact with water or react (oxidize) under ambient conditions to generate acidic drainage (or acid rock drainage), which can increase the rate of chemical release from the wastes. Residuals from explosives (nitrate and ammonia) and mill process reagents such as cyanide and sulfate compounds, if present, can also add to the contamination potential of the wastes. The chemical composition and structure of chemical compounds in the wastes and contact waters can affect their release mechanisms. Understanding these processes is necessary for the design of effective contaminant control measures, optimization of water management and water treatment, and effective mine closure.

Stornoway Diamond Corporation's Renard Mine in northern Quebec is one case in point. Rigorous baseline studies on water, soil, rock, air, and the receiving environment at the project stage informed the mine waste and water infrastructure designs and management plans. Due to the sensitivity of the pristine receiving environment, the full mine footprint was designed to be contained within one small watershed in order to minimize contact water management needs. Some potential contaminants were identified in specific waste streams in the form of low solubility silicate minerals, which have the potential to be released as suspended solids in site drainage. Residual nitrogen products from explosives use were also identified as potential contaminants in mine contact water. Identification of these sources and their release mechanisms were used to design control mechanisms for operation and prepare for clean closure at the onset of the project. The domestic wastewater is treated to remove nitrate, ammonia, and phosphorus through a nitrification/de-nitrification biological treatment process and membrane filtration.

All site contact waters at the Renard Mine are captured, pumped, and treated to remove suspended solids to levels that are well below the effluent limits in order to prevent the release of chemicals to the receiving environment. A robust explosives management plan is in place to minimize explosives use and loss during mining, minimizing the contaminant charge on mine waste contact water. Treated separately through a high-tech facility including a final stage of micro filtration at four microns, the effluent discharge water quality surpasses the highly restrictive limits set by the province.

Key elements

Robust waste and water management plays a key role in the fiscally, socially, and environmentally responsible operation and closure of mining facilities. For these plans to be effective, they must be adapted to site specific conditions, be adaptable to operational changes, and be integrated in the process of planning for permanent closure.

Key elements of water and waste management plans for the responsible use of resources include:

- A water balance where all water inflows and outflows are identified and quantified, accounting for forecasted changes in climate.
- Reduction of mine contact water volume by diverting clean water from the site and reusing process water or mine contact water to the extent possible, minimizing freshwater use.
- Handling of contact water by segregation of the different water types for efficient and effective treatment.
- An understanding of the contaminant sources: the chemical and physical properties of the wastes generated, their reactivity under site conditions, and their variability.
- An understanding of the properties of the receiving environment, its absorptive capacity, and cumulative effects.

Mining certainly presents a technical challenge when it comes to water management. The complexities that sites present from geochemical interactions, to infrastructure site selection, to climate change considerations, provide an exciting field of practice. Ultimately, with careful planning, diligent oversight, and innovative thinking, we are able to mine responsibly while protecting our water resources. WC

Valérie Bertrand is an associate and geochemist at Golder.

APPOINTED

CHANDRA SHARMA

Chandra Sharma joined the Niagara Peninsula Conservation Authority (NPCA) as the chief administrative officer and secretary-treasurer on January 1, 2020.

"Our new CAO brings to the role more than 20 years of progressive leadership experience in strategy, governance, operations, and program development," said Dave Bylsma, chair of NPCA's Board. "We are excited to have her join the amazing team we already have in place and continuing to move the NPCA forward."

Chandra Sharma began her career at Toronto and Region Conservation Authority (TRCA) as a stewardship coordinator. She quickly moved through progressively more senior roles as project manager of the Humber River watershed, watershed specialist, and senior manager of climate programs.

SANDRA COOKE

The Canadian Water Network (CWN) has welcomed **Sandra Cooke** as the director of the Canadian Municipal Water Consortium.

Prior to joining CWN, Cooke was the senior water quality supervisor at the Grand River Conservation Authority (GRCA). In this role, she managed the conservation authority's watershed management plan.

Cooke has held a number of progressive leadership positions at GRCA and the Government of Alberta. She also has a rich history of bringing municipalities and other water stakeholders together.

CWN also announced that **Carl Yates**, retired general manager of Halifax Water, has been appointed as chair of its Board of Directors.

KAREN RAS

Mississauga Councillor **Karen Ras** was acclaimed as chair of Credit Valley Conservation (CVC) during a board meeting on January 17, 2020.

TOM ADAMS

The election marks Ras' second term as chair and her sixth year of service on the CVC Board of Directors.

"I'm honoured to be acclaimed as chair of Credit Valley Conservation," said Councillor Ras. "These are important times for Ontario conservation authorities."

The CVC Board of Directors also acclaimed Town of Oakville Councillor **Tom Adams** as vice chair. Adams has served on the CVC board since 2011 and previously served as vice chair in 2013 and 2019.

NANDITA BASU

Nandita Basu, an associate professor at the University of Waterloo, has been named as the director of the university's Collaborative Water Program.

"Nandita Basu studies the role humans play in modifying water availability and quality through changing land use and climate," according to the University of Waterloo. "She actively collaborates with ecologists, social scientists, and economists to explore other aspects of sustainable water management as part of her research."

In her new role, Basu welcomed a new cohort of 40 students into the Collaborative Water Program on January 10, 2020.

MIKE MORTIMER

During its annual general meeting, the Ontario Municipal Water Association (OMWA) elected **Mike Mortimer**, manager of environmental services for the City of Stratford, as its new president.

"I am excited to be able to take on the role as president of the OMWA and am committed to leading the organization and carrying on the dedicated efforts of past presidents," said Mike Mortimer. "As the water and wastewater industry landscape continues to evolve, it is imperative that the OMWA continuously reflects on our mission statement, our mandates and why we do what we do."

RICHARD FLORIZONE

Richard Florizone has been named the new president and chief executive officer of the International Institute for Sustainable Development (IISD), a research organization dedicated to accelerating the global transition to clean water, fair economies, and a stable climate.

"Richard is a recognized thought leader and innovator," said Alan Young, chair of the Board for IISD. "He has a proven record of running complex organizations, working with diverse stakeholders to ensure core values are protected, and [ensuring] strategic growth is prioritized."

Florizone joins the organization with expertise in bringing public and private sectors together to reach ambitious, multi-faceted goals.

ELLIOTT CAPPELL

WSP announced that it has appointed **Elliott Cappell** to lead its climate change and resilience activities.

"The greatest benefit we can provide our clients when addressing the issue of climate change is our expertise," said Olivier Joyal, executive vice president of WSP. "WSP has a strong service offering when it comes to resilience and the impacts of climate change in the natural and built environments. The knowledge and experience that Elliott brings to the company takes us further as we help our clients meet the challenges of today and prepare our society for the challenges of the future." WC

Professor Kim Gilbride from Ryerson University spoke about the use of antibiotics and their impact on wastewater treatment plants.

Eric Meliton, a program manager at the Toronto and Region Conservation Authority, spoke about industrial water use during a session on urban water use and demand.

Steven Liss, vice president of research and innovation at Ryerson University, spoke about distributed water management during a session on technical measures.

Urban Water Symposium Toronto, Ont.

Wastewater treatment plants are contributing to antimicrobial resistance worldwide.

This was one of the key takeaways from a presentation by **Kim Gilbride**, a professor in the Department of Chemistry and Biology at Ryerson University, during the Urban Water Symposium. The event was hosted by Ryerson Urban Water and Wageningen University and Research (WUR).

Gilbride spoke as part of a session on water quality. She was joined in the discussion by **Claire Oswald** from Ryerson University, who spoke about the Provincial Water Quality Network, and **Stephanie Melles** from Ryerson University, who spoke about the Broad-Scale Monitoring Network. These speakers were also joined by **Paul Helm** from Ontario's Ministry of the Environment, Conservation and Parks who spoke about why microplastics are a concern and about the effects being documented. The final speaker, **Sha Gao** from WUR, in the session spoke about advanced factors impacting microbiological water quality.

During her presentation, Gilbride spoke about contaminants of emerging concern, with a focus on antibiotics. She indicated that antibiotics play an important part in reducing the economic, medical, and social burdens associated with treating infectious diseases. "First-line antimicrobials contributed to saving at least 17,000 lives and prevented 2.6 million hospital days," according to information Gilbride obtained from the Council of Canadian Academies.

Where does that leave us? "The amounts of contaminants of emerging concern in Canada is unknown, the technology to remove pharmaceuticals is not established, and the amount of contaminants of emerging concern leaving wastewater treatment systems is also unknown," according to Gildbride. WC

BY ROBERT HALLER

OUR KEYNOTE SPEAKER in Banff, Grant Ainsley, made it very clear to all that we are in the public attitudes business. While for years we have gone about quietly providing safe drinking water and making wastewater clean, we are in a very different world now and almost EVERY aspect of our work involves addressing public attitudes.

Public confidence in their tap water is a serious concern for us all. Incidents like Walkerton and Flint don't portray us very well, nor is that a true representation of our profession. But public awareness and questions around lead, manganese, and fluoride can cause some serious doubt in our customers. The Canadian Water and Wastewater Association (CWWA) continues to respond to the national media and to support you, our members, with relevant materials on these issues so that you can speak to your citizens and local media. This includes information of the role of the homeowner to cooperate in lead reduction plans. Interest around PFAS (PFOS/PFOA) is growing in the U.S. and will garner a lot of attention with the release of the new film Dark Water. The CWWA will leverage our partnerships with WEF, AWWA, and NACWA to keep you informed on these issues.

Maintaining a working sewer system means getting the public to think about their actions and to stop using their toilets as garbage cans. This includes efforts around, flushable products, hygiene products and medications. On the stormwater front, mitigating flood risk will require significant participation by property owners to 'flood proof' their properties with grading, capture and backflow controls.

Then there is the big, overriding issue of infrastructure renewal and the investment that is required. In order to do what we really need to do, we will need public support for the investment required, and the disruption that comes with it. This can only be accomplished through efforts to build the value of water amongst Canadians. The CWWA is proud to be a sponsoring partner of the blueW.org campaign to promote tap water and we encourage our member municipalities to come on board. We are considering seeking funding for a new pilot project and looking for some new partners to come on board… so expect a call out from me soon.

How long this federal minority situation lasts is anyone's guess, but it should be very interesting. There will certainly need to be more compromise and middle-ground found between the NDP/Green environmental pressures and the conservative's seeming reluctance to the current policies and program proposals. Previous minority governments have accomplished a great deal and we can have hope for a lot from this next session.

I am happy to see Jonathan Wilkinson back with Environment and Climate Change Canada as the new minister. As the parliamentary secretary for the Environment, and then Fisheries Minister in the last session, he is well versed on the Wastewater Systems Effluent Regulations (WSER) and our calls for more flexibility within the regulations. He may also be a less polarizing voice to the provincial/territorial premiers. Meanwhile, the former Environment Minister, Catherine McKenna, has shifted to the Infrastructure portfolio and sees this as the practical arm of the environmental campaign. I have been saying for years that the national infrastructure program is not so much about infrastructure as it is seen as a tool for addressing our climate change commitments and support for the Canadian innovation sector. I have not worked with Bill Blair yet, but expect he will carry forward the efforts begun by Ralph Goodale on a national flood risk strategy. WC

Robert Haller is the executive director of the Canadian Water and Wastewater Association.

EVERYONE DESERVES LEAD-FREE WATER

The Residential and Civil Construction Alliance of Ontario (RCCAO) is proud to support the hard work of our members in addressing the removal of lead-based water infrastructure to ensure that every Ontarian, and every Canadian, can have safe, clean drinking water free from lead contamination.

To learn more about how RCCAO advocates for the residential and civil construction sectors' drive to build safe, resilient and responsible projects across Ontario, visit rccao.com. Go to the Research & Reports link at rccao.com/research to find our Water Systems reports.

"In light of the recent media reports of lead in water systems, this is an issue that deserves more action. But that is only the beginning. All forms of government – federal, provincial and municipal – need to work with industry and the public to resolve this issue to ensure the safety of every Canadian."

Andy Manahan, RCCAO executive director

OUR PARTNERS

Thank you to our members and colleagues for their ongoing diligence in addressing the continuous improvement of water systems

- Carpenters' District Council of Ontario
- Greater Toronto Sewer and Watermain Contractors Association
- Heavy Construction Association of Toronto
- International Union of Operating Engineers, Local 793
- Joint Residential Construction Association
- LiUNA, Local 183
- Ontario Formwork Association
- Toronto and Area Road Builders Association
- Ontario Sewer and Watermain Construction Association
- Ontario Society of Professional Engineers

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