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DRINKING WATER

8 Closing the Gaps

What needs to happen to protect everyone's drinking water in Ontario?

BY **TERRY REES**
AND **THERESA MCCLENAGHAN**

12 What's Up with Legionella?

Information suggests that Legionellosis outbreaks are increasingly a problem.

BY **ARNE FAREMO**
AND **KALPNA SOLANKI**

STORMWATER

14 Forging Ahead

Lake Simcoe study points to a new direction for stormwater planning.

BY **TRACY PATTERSON**

EMERGING CONTAMINANTS

18 A Class of Their Own

PFAS compounds are an emerging concern.

BY **SAUL CHERNOS**

CLEANTECH

22 Fostering Innovation

What does it take to succeed in the water and wastewater sector?

BY **TRISH JOHNSON**



12



22



26



28



30

WATER RESOURCES

26 Wildfires in our Watersheds

"Code red" for source water supply.

BY **FRANÇOIS-NICOLAS ROBINNE**
AND **KEVIN D. BLADON**

BLUE ECONOMY

28 Driving Diversity in Canada's Water Industry

Increasing diversity can help organizations remain competitive and productive.

BY **SIMRAN CHATTHA**

CHALLENGES & OPPORTUNITIES

30 Modern Data Management

Exploring the key elements for overcoming challenges related to water data management.

BY **ERIK LARSON**

DEPARTMENTS

5 Editor's Note

SIMRAN CHATTHA proposes topics to keep an eye on in 2022 and beyond.

6 Front

Massive Investment Needed to Ready Canada's Infrastructure for Climate Change, Rubber Tire-Derived Chemicals in Stormwater.

34 People & Events

Appointments, announcements, and event reports.

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Looking Ahead

BY SIMRAN CHATTHA

IT'S HARD TO BELIEVE that 2021 is slowly coming to an end. Instead of reflecting on the past year, I would like to look ahead to 2022 and beyond. Here are some topics I think we need to keep an eye on:

Renewal and/or replacement of water infrastructure.

Municipalities are continually thinking about how to renew and repair their linear water assets. As municipalities address their infrastructure needs, new technologies and existing methods are poised to play a pivotal role.

Infrastructure investments.

Since the outset of the pandemic, the federal and provincial governments have been investing in infrastructure, including water and wastewater infrastructure, to stimulate the economy. While these investments are welcome, we need to keep in mind that we need to continually make these types of investments. This is so that all communities can reap the benefits, like reliable access to safe drinking water, that come with the investments.

Cyber security. As technology advances, so does the risk of cyber attacks. This was evident in 2021 as there were a number of high-profile attacks, including one that occurred in Florida. While a hacker took advantage of a

vulnerability in a water treatment plant, a plant supervisor saw the issue and fixed it before it could affect the local water supply. Similar incidents are on the rise and it is imperative that water utilities take steps to prevent similar attacks from occurring in the future.

Water as an investment space.

An article by Cameron French in *The Globe and Mail* noted that “big-picture appeal of water as an investment space has been a growing story over the past few years.” This is partly because the appeal of responsible investing has been growing. As the interest grows, the water sector can benefit from the capital that is going into funds that take Environmental, Social, and Governance (ESG) factors into account.

Water supply in the long run.

Given the impacts of climate change, we can't be sure that our water supply will always be safe and secure. For this reason, we need to be careful as we consider and implement water management decisions. **WC**

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TERRY REES
Terry is the executive director of the Federation of Ontario Cottagers' Association.
PG. 8



THERESA McCLENAGHAN
Theresa is the executive director of the Canadian Environmental Law Association.
PG. 8



FRANÇOIS-NICOLAS ROBINNE
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PG. 26



KEVIN D. BLADON
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PG. 26



Massive Investment Needed to Ready Canada's Infrastructure for Climate Change

A NEW REPORT finds that climate change impacts could leave Canadians physically and financially under water as a warming and increasingly volatile climate damages public and private infrastructure. Homes, buildings, and critical infrastructure are all at risk, unless new investment and improved regulation make these assets more resilient to the changing climate.

"Climate change is a massive threat to the public and private infrastructure that underpins Canada's prosperity," said Ryan Ness, adaptation research director at the Canadian Institute for Climate Choices. "The challenge for governments today is to rapidly shift how infrastructure decisions are made in ways that factor in a changing climate. If these investments are planned wisely, Canada's infrastructure can be the foundation of a resilient, low-carbon future."

Under Water: The Costs of Climate Change for Canada's Infrastructure is the largest study to date of these kinds of impacts, according to the Institute. The report focuses on three types of climate change impacts to some of Canada's most vital infrastructure: flooding of homes and buildings, damage to roads and rails, and impacts on Canada's electricity grids. Findings include:

- 1 Flood damage to homes and buildings could increase fivefold by mid-century and tenfold by end of century, with costs as high as \$13.6B annually.
- 2 Damage to roads and railways could increase by up to \$5.4B annually by mid-century and by as much as \$12.8B annually by end of century.
- 3 Costs to repair and maintain electrical infrastructure could more than double by mid-century and triple by end of century, costing up to \$4.1B annually. *wc*

ABOUT THE COVER

Extreme fires can dramatically alter the natural processes of forested watersheds in storing and transmitting water. Learn more on page 26.

Coming up in the next issue

JANUARY/FEBRUARY

Contaminants of Emerging Concern

• • • • •

Tackling Plastics in Freshwater

• • • • •

Advancing Municipal Co-digestion

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Saskatoon and USask Study Rubber Tire-Derived Chemicals in Stormwater

THE CITY OF SASKATOON and University of Saskatchewan (USask) recently collaborated on a study to see if chemicals that leach from rubber tires are entering the stormwater system. Water that enters storm drains, through snowmelt or rain runoff, flows into the South Saskatchewan River.

“Chemicals from rubber tire leachate have been associated with mortalities in Coho salmon in Washington State,” said Markus Brinkmann, assistant professor in the School of Environment and Sustainability at USask. “However, we currently don’t know the effects on wildlife in our region. The results, in what we believe is the first study of its kind in a Canadian municipality, show high readings of the tire rubber related compounds in Saskatoon’s runoff.”

The findings are a result of samples

taken from snow facilities, snowmelt puddles, and about a dozen outfall sites along the South Saskatchewan River within the city in 2019 and 2020. The study indicates the high concentrations may relate to occasional but intense rainstorms in the summer and snowmelt in the winter. Both types of events can lead to significant accumulation followed by sudden flushing of tire rubber chemicals from roads into the stormwater system.

Russ Munro, director of Saskatoon Water, says further research is required to better understand the factors driving the findings. “This is a great example of why continued research and partnerships with institutions like the University of Saskatchewan are so important,” said Munro. *wc*

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Credit: Comox Valley Regional District

NEWS: New Water Treatment Facility in Comox Valley.
bit.ly/TreatmentFacility



Credit: University of Saskatchewan

NEWS: Research Examines Presence of Pharmaceuticals in Saskatoon’s Wastewater.
bit.ly/SaskatoonWastewater



Credit: Nature Conservancy of Canada

NEWS: New Project Maps Hydrologically Significant Areas in Red Deer River Watershed.
bit.ly/RedDeerRiverWatershed



Credit: Metro Vancouver

NEWS: Vancouver Completes Excavation for Second Narrows Water Supply Tunnel.
bit.ly/SecondNarrowsWater

Closing the Gaps



What needs to happen to protect everyone’s drinking water in Ontario?

BY TERRY REES AND THERESA MCCLENAGHAN

ONTARIO’S DRINKING WATER protection framework has correctly been lauded as exceptional. However, improved implementation and sustained investment is needed now to extend protection beyond municipal systems and ensure safe drinking water for all.

The legacy of events in Walkerton, Ontario that occurred in May 2000 has resulted in a significantly improved legal framework for drinking water protection that includes a multi-barrier approach. As the 20th anniversary of the Walkerton Inquiry Reports approaches in 2022, full implementation of the Inquiry recommendations has yet to be achieved. This leaves significant unfinished business that must be urgently addressed to ensure drinking water safety for all, particularly the

18 per cent of Ontario’s population that is not currently covered by existing source protection plans.

People who draw drinking water from domestic wells in villages, hamlets, and towns that lack municipal drinking water systems do not currently have any legally enforceable safeguards under approved source protection plans. For example, the Auditor General of Ontario reported that approximately 1.6 million Ontarians use private wells for drinking water purposes—and are therefore not protected under the current legislative framework. This is urgent and unacceptable, particularly since the applicable legislation, the *Clean Water Act*, contains sections that would address these situations.

The Ontario Ministry of the Environment, Conservation and Parks has decided not to utilize these powers, thus leaving these communities unprotected by the multi-barrier approach that Justice O’Connor recommended.

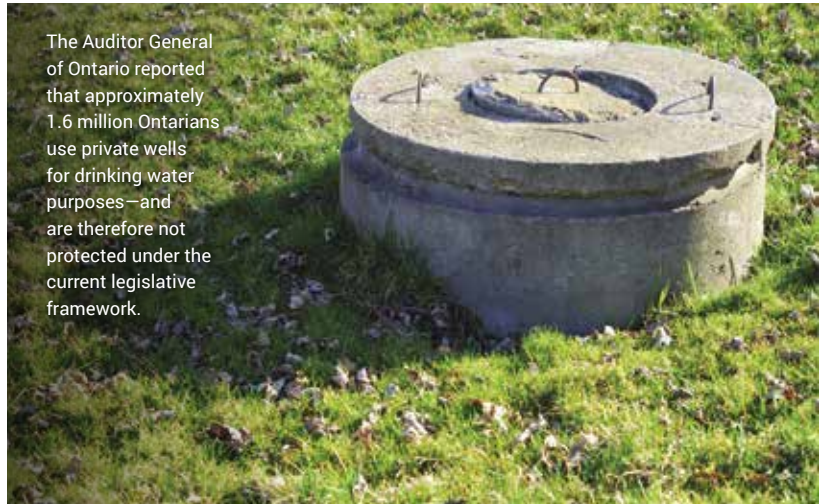
What happened after Walkerton?

As information about the devastating impact of drinking water contamination in Walkerton was unfolding, the Ontario government established a Commission of Inquiry and appointed Justice Dennis R. O’Connor as Commissioner. In January and May 2002, Commissioner O’Connor delivered Part One and Part Two (respectively) of the Report of the Walkerton Inquiry.

Commissioner O’Connor concluded



Commissioner O'Connor suggested that drinking water sources be protected on a watershed basis as part of a comprehensive approach.



The Auditor General of Ontario reported that approximately 1.6 million Ontarians use private wells for drinking water purposes—and are therefore not protected under the current legislative framework.



that a cornerstone of an effective system of protection for drinking water was to ensure a multi-barrier approach. Protection of drinking water sources was suggested to best be done on a watershed basis as a component of a comprehensive approach to all waters.

There is significant unfinished business that must be urgently addressed to ensure drinking water safety for all.

“Drinking water source protection, as one aspect of watershed management, makes the most sense in the context of an overall watershed management plan. In this report, I restrict my recommendations to those aspects of watershed management that I think

are necessary to protect drinking water sources, but I want to emphasize that a comprehensive approach for managing all aspects of watersheds is needed and should be adopted by the province. Source protection plans should be a subset of the broader watershed management plans.”

After passing the *Safe Drinking Water Act* in 2002 to address drinking water treatment, testing and distribution, Ontario enacted the *Clean Water Act* in 2006 to address the Inquiry recommendations regarding drinking water source protection. Twenty-two source protection regions and areas were established, along with multi-stakeholder source protection committees for each one. At present, all

22 source protection plans have been approved by the Environment Ministry, and are currently being implemented, monitored, and refined at the local level.

This achievement, while commendable, is only part of the job of safeguarding the quality and quantity of sources of drinking water across the province.

Why isn't it enough?

To date, the approved source protection plans have been limited to water sources used only by a few First Nations and most (but not all) municipal drinking water systems in Ontario.

For years since the events in Walkerton, the province's chief drinking water inspector has consistently found that about 99.9 per cent of the water testing results from municipal residential drinking water systems met Ontario's “strict” drinking water quality standards.



Credit: Terry Hayes

People who draw drinking water from domestic wells in villages, hamlets, and towns that lack municipal drinking water systems do not currently have any legally enforceable safeguards under approved source protection plans.

Based on these favourable test results, Ontario often proclaims that the multi-barrier approach to protecting drinking water has made tap water in the province among the best protected in the world.

While this claim may be valid for the majority living in urban centres and larger towns, it is not necessarily true for most First Nations or for residents who consume water from private wells or private surface water intakes. If the provincial government wants to ensure and enhance drinking water safety for all residents of Ontario, then it needs to fully implement the provisions of the *Clean Water Act* regime; this is both necessary and desirable in the public interest.

There are three crucial gaps in the current state of implementation of the *Clean Water Act*:

- 1 Drinking water sources located outside a defined source protection area, including many municipalities.
- 2 Drinking water sources located within a defined source protection

area but excluded from the protective plan policies that only apply to municipal wellheads or intakes in surface water bodies, such as whole towns and villages that utilize private wells but access the same aquifer.

- 3 Drinking water sources utilized by many Indigenous communities, with differing technical, financial, and jurisdictional challenges, depending on whether the sources are within, adjacent to, or outside defined source protection areas.

With respect to the last gap, the fact that only a very few First Nations have opted into the *Clean Water Act*, and that making use of this policy solution requires active involvement by the nation, and the federal government, has limited the number of Indigenous communities protected by the source water protection system in Ontario.

Closing these gaps is crucial because for some people, such as those whose drinking water comes directly from a private well supplied by a local

aquifer, protecting the source is the only preventative barrier open to them within the multi-barrier approach.

For others, such as those whose drinking water comes from Muskrat Lake, including the Village of Cobden in the Township of Whitewater Region, the municipal system is not within a source protection area. As such, even though the water quality of Muskrat Lake is recognized as the poorest in Renfrew County, it is not currently being assessed for drinking water threats and there are no policies in place to reduce the risks.

The Village of Cobden is not alone. Over 40 municipal drinking water systems throughout Ontario are not covered by the *Clean Water Act* and, therefore, do not have source water protection plans to prevent the contamination of their sources of drinking water. Even in what seems like an urban setting, with paved streets, commercial and industrial activities, and high-density housing, there are sources of drinking water that are not yet protected through the *Clean Water Act* or otherwise.

Further, safeguarding drinking water

Extending the protective coverage of the *Clean Water Act* beyond only the currently covered municipal drinking systems is long overdue, according to Terry Rees and Theresa McClenaghan.



for First Nations requires particular attention. Decision-makers at the federal and provincial levels must ensure that resources are directed to Indigenous-led, participatory processes that will respectfully and meaningfully

Municipalities do not have sufficient tools under the Planning Act to regulate land uses that may adversely affect groundwater resources.

address and remedy the challenges of those drinking water systems.

What needs to happen next?

Coverage for non-municipal drinking water systems in the *Clean Water Act* is absolutely necessary. The legislation already exists to do so; it just needs to be activated. There has been some indication by the Ontario government, in responding to submissions from Canadian Environmental Law Association, Federation of Ontario

Cottagers' Associations, and others that adequate tools exist outside of the *Clean Water Act*. This is not true. Municipalities do not have sufficient tools under the *Planning Act* to regulate land uses that may adversely affect groundwater resources; the *Planning Act* may be useful for addressing proposed changes to land use but is of limited value when current land uses pose threats to source water protection.

Additionally, sustained investment is necessary for both extending and implementing source protection planning under the *Clean Water Act* to fill the three policy gaps identified and for implementing existing source protection plans. Earlier stages of implementing a multi-barrier framework for Ontario drinking water protection relied on adequate technical funding that preceded adoption of the specific source protection plans. This same approach is critical to ensuring

protection for the rest of Ontario. It will be necessary to adapt to changes including emerging risks, threats, and other pressures, particularly as the population increases and we continue to face the twin crises of biodiversity loss and climate change.

Extending the protective coverage of the *Clean Water Act* beyond only the currently covered municipal drinking systems is long overdue. If this is done in an appropriate and timely manner, and if it is properly funded, then enhanced source protection efforts will be instrumental in ensuring public health, safeguarding waters, and saving costs in the long-term. WC

Terry Rees is the executive director of the Federation of Ontario Cottagers' Associations and member of the Trent Conservation Coalition Source Protection Committee.

Theresa McClenaghan is the executive director of the Canadian Environmental Law Association and Counsel during the Walkerton Inquiry.

When water containing the bacteria is aerosolized via ornamental fountains, people nearby can be exposed to Legionella when they breathe in the mist.



What's Up with Legionella?

Information suggests that Legionellosis outbreaks are increasingly a problem.

BY ARNE FAREMO AND KALPNA SOLANKI

ALMOST EVERY WEEK, there are Legionellosis outbreaks, mainly in cities, throughout North America. So, what's going on? Are we seeing a higher number of cases because of climate change, higher density living, better diagnosis? The studies do not conclusively identify any one of the aforementioned parameters, but the information suggests Legionellosis outbreaks are increasingly a problem.

Causes of Legionellosis

Legionellosis and Pontiac Fever are most often caused by the bacteria Legionella pneumophila. These bacteria grow within amoeba and other protozoans that colonize biofilms that are present on virtually all surfaces that contact water.

Although the bacteria are quite common in nature and cause few problems there, they can flourish in building water systems such as pipes, cooling towers, tanks, and other components of a human built environment when there is a combination of stagnant

water, warm temperatures, and a lack of disinfectant residuals.

When water containing the bacteria is aerosolized via cooling towers, hot tubs, shower heads, irrigation systems, ornamental fountains, or cooling towers, people nearby can be exposed to Legionella when they breathe in the mist. Risk factors for severe Legionellosis include being male, over 50 years of age, having a history of smoking, and being immunocompromised.

Dealing with outbreaks

Rates of Legionellosis in B.C. and Canada increased between 2002 and 2018. A review of the cases in the United States shows similar trends. Monitoring the trends shows there is a reason to be concerned about the incidence of Legionellosis.

For outbreaks where a source of infection is identified, poorly managed cooling towers are most often identified as the source of infection. This is the reason why, in the United Kingdom

in 1992, a cooling tower registry was implemented. In Canada, the only jurisdictions with a similar registry are the City of Hamilton in Ontario, the Province of Quebec, and the City of Vancouver in British Columbia. Hamilton, unlike Quebec and Vancouver, does not require monthly testing.

In jurisdictions that have cooling tower registries, when there is an outbreak and a suspected exposure area is identified, it is relatively simple and much faster to identify and remediate cooling towers which may have contributed to the outbreak. Rapid identification of Legionella sources also reduces the chances of more vulnerable people from being exposed and infected.

To prevent an outbreak from occurring, ensure that building water system risks are assessed and controlled, including choosing qualified service support, establishing a written water management plan with emergency remediation procedures, and monitoring the system regularly with testing to validate the

effectiveness of management controls. Furthermore, ensuring that individuals including site staff who maintain these building water systems are appropriately trained and certified, goes a long way towards preventing outbreaks from occurring.

In late 2019, the City of Vancouver, working with Vancouver Coastal Health, approached the Environmental Operators Certification Program (EOCP) with the potential of working together to develop and launch a new certification, the Building Water Systems (BWS) certification.

The new BWS certification comprises of an entry-level short course introduction to a number of topics, including water system basics (water sources, primary and secondary treatment, and distribution networks), water quality parameters (physical, chemical and microbiological) and standards, and interpretation of test results.

The City of Vancouver, Vancouver Coastal Health, and the Environmental Operators Certification Program worked collaboratively to launch the new BWS certification was EOCP's annual conference in September 2020. The certification requires experience related pre-requisites, completion of an accredited course, an exam, and subsequently payment of dues and completion of professional development.

It is expected that there will be more Canadian jurisdictions implementing cooling tower registries and/or mandatory training and certification of those who maintain building water systems. This disease is preventable, and there are options available to significantly reduce the number of cases. WC



Arne Faremo is a project specialist at Vancouver Coastal Health.

Kalpna Solanki is the president and CEO of the Environmental Operators Certification Program (EOCP).

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The Lake Simcoe Region Conservation Authority, located in southern Ontario, compared the current municipal approach to stormwater management with an alternative approach.

Credit: Lake Simcoe Region Conservation Authority



Forging Ahead

Lake Simcoe study points to a new direction for stormwater planning.

BY TRACY PATTERSON

AS A SUMMER OF climate change extremes comes to a close and many in the water sector are grappling with the implications, findings from a two-year stormwater management and economic study point to a new way forward in building more resilient, water secure communities.

The study, led by the Lake Simcoe Region Conservation Authority that's located in southern Ontario, comparatively evaluated the current municipal approach to stormwater management with an alternative approach. Currently, municipalities site stormwater infrastructure on available public lands exclusively within their municipal borders. The alternative

approach, modelled what would happen if municipalities in a shared watershed collaborate across political boundaries for watershed-level stormwater management and consider both public and private lands to achieve 'optimal' siting of stormwater infrastructure. The watershed-wide, collaborative approach delivered not only better water quality and reduced stormwater runoff when compared with current municipal approach, it did so at 28 per cent lower cost.

The most recent report by the Intergovernmental Panel on Climate Change, representing more than 200 scientists and incorporating thousands of climate studies, is "unequivocal"

that human-caused climate change is upon us. According to the report, even with widespread and rapid cuts in emissions, the next 30 years will bring more frequent and extreme weather and with it, flooding, polluted water sources, heatwaves, and droughts. Adaptation will be critical to mitigating these impacts. According to Dr. Ben Longstaff, integrated watershed manager at the Conservation Authority and study lead, "finding a more cost-effective way to adapt our stormwater infrastructure was a major objective of the study."

Comparing stormwater management approaches

The East Holland River watershed,



The costs associated with flood damage across Canada exceeded \$2.4 billion in 2020 alone, according to the Insurance Bureau of Canada.



New ideas for improving how stormwater is planned and managed are critically needed as municipalities deal with the compounding challenges of climate change, urbanization, and increasing liability risks.



According to the most recent IPCC report, the next 30 years will bring more frequent and extreme weather and with it, flooding, polluted water sources, heatwaves, and droughts.

located in northern York Region and one of the fastest urbanizing areas in Canada, was the selected location for the study. The watershed drains into Lake Simcoe, a large inland lake threatened by excessive pollutant-laden runoff. This contaminant threat combined with provincial water

Change management comes with its own set of challenges and as the saying goes, the devil is in the details.

quality goals for Lake Simcoe led the project team to set a study target of 40 per cent phosphorus reduction to the lake.

A computer model and decision support system were developed for the East Holland

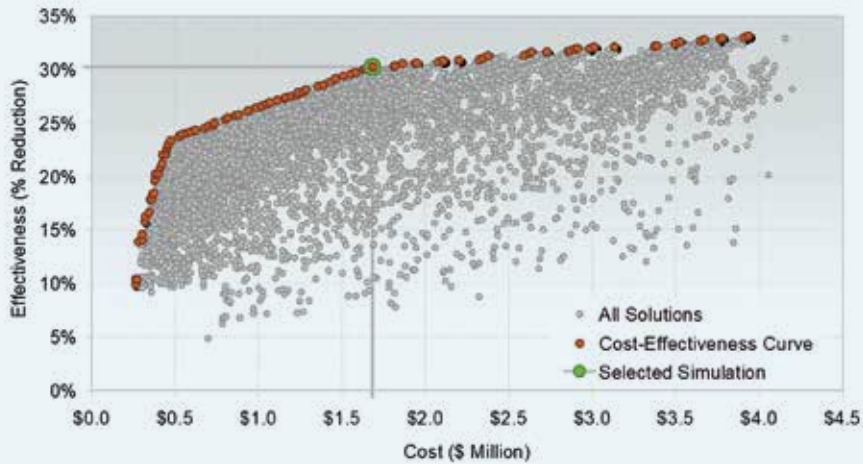
River watershed to analyse strategies to manage stormwater based on their impact on watershed processes and their cost-effectiveness. Detailed life-cycle costs for infrastructure were included in the model to compare the current municipal approach to stormwater management with the alternative “system-wide” approach. In order to evaluate the two approaches under future conditions, projected climate change pathways and planned growth and development scenarios were baked into the computer model.

Developed by the US Environmental Protection Agency, the computer

model known as SUSTAIN processes hundreds-thousands of stormwater management options under current and future state conditions, such as climate change, to generate cost curves.

Each dot in the cost curve represents an entire stormwater management strategy—a combination of ‘representative’ measures from hybrid wetlands and rain gardens to infiltration trenches and green streets. Moving left to right along the bottom axis, costs increase. The red dots along the top of the cost curve represent the more cost-effective strategies; in other words, they provide the greatest stormwater management performance for the cost. The red dot within the green circle represents the most

Example cost curve generated by the computer model



cost-effective strategy based on the study objectives and targets.

Building resiliency through collaboration

As municipalities in Canada struggle to address a legacy of insufficient stormwater control with limited resources while facing the compounding challenges of climate change, urbanization and increasing liability risks, new ideas for improving how stormwater is planned and managed

The study showed that by working collaboratively and sharing expertise, municipalities can better plan and manage stormwater.

are critically needed. As Anca Mihail, manager of engineering and capital delivery at the Town of Aurora, one of the study partner municipalities, sees it: “The study clearly showed that by working collaboratively and sharing expertise and resources, municipalities can better plan and manage stormwater, lower costs, and build resilient, future-ready systems.”

Beyond intermunicipal collaboration

for watershed-level stormwater management, the system-wide approach also included private lands as potential sites for stormwater control measures. When asked why private properties were incorporated into the alternative approach, Dr. Longstaff explained, “the majority of property in a municipality is privately-owned... so logically, the best locations for stormwater management measures will likely include private properties, as well as public ones.”

In fact, the model selected multiple private lands as preferred or optimal sites for stormwater infrastructure over some public land locations and readily met the study target of 40 per cent phosphorous reduction. Contrast this finding with a maximum achievable phosphorous reduction of only 15 per cent using solely available public lands for infrastructure as is the current practice of municipalities in Canada.

While some see potential problems with securing private property participation and ensuring proper construction and maintenance of

stormwater measures on privately-owned lands, Rachel Prudhomme, director of engineering services at the Town of Newmarket, another study partner, thinks it time municipalities reconsidered their relationship with private landowners. According to Prudhomme, “the [study] findings clearly point to the benefit of working together with property owners to find collective solutions. We all want to live in greener, healthier communities and we all benefit from better air quality, cleaner streams and lakes, and reduced risk of flooding and property damage.”

Making the transition to system-wide stormwater management

Change management comes with its own set of challenges and as the saying goes, the devil is in the details. The Conservation Authority and seven project partner municipalities with interest in the East Holland River watershed are leading the development of a detailed implementation blueprint. Mihail describes this process as “...breaking new ground, so all options are on the table. We need to understand the implications—economic, legal, administrative, operational, and more—and carefully screen for viable options to build a workable plan moving forward.”

The costs associated with flood damage across Canada exceeded \$2.4 billion in 2020 alone, according to the Insurance Bureau of Canada. Going forward, more frequent and extreme storms are expected to be brought about by climate change. Given that this is the case, “there is a pressing need for a new stormwater management paradigm... one where municipalities and private landowners in a shared watershed work together to better manage stormwater and create healthier, greener and safer communities,” says Dr. Longstaff. **wc**



Tracy Patterson is principal at Freeman Associates Ltd.



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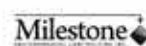
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A Class of Their Own



PFAS compounds are an emerging concern. **BY SAUL CHERNOS**

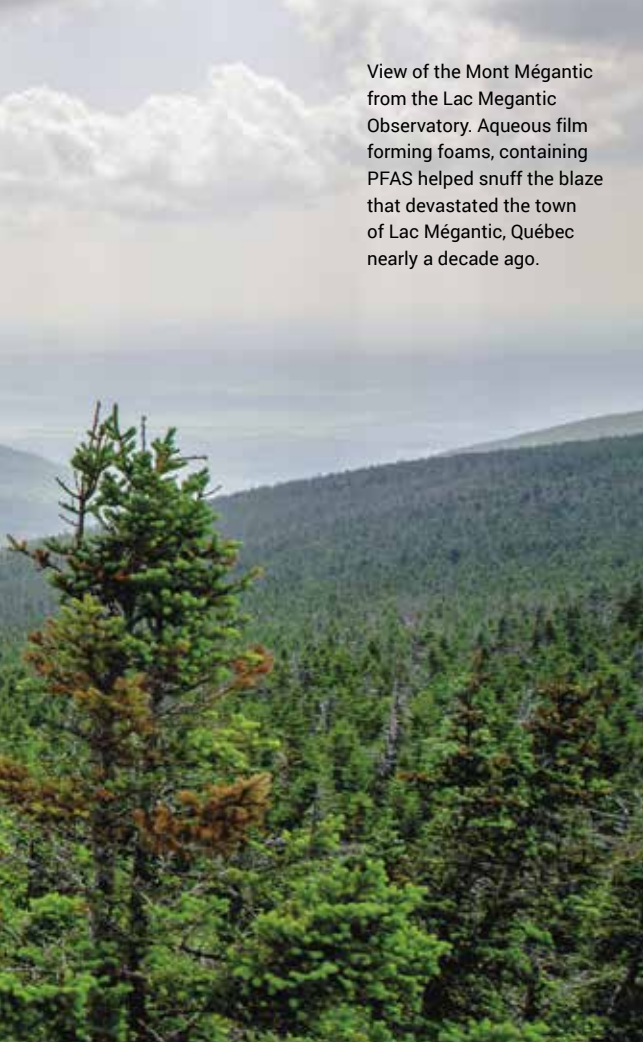
A CLASS OF CHEMICALS used for more than half a century in everyday goods such as clothing, cosmetics, and consumer electronics is finding itself under global scrutiny. Perfluoroalkyl and polyfluoroalkyl, known generically as PFAS, are so tightly bound and stable they offer unmatched resistance to heat, oil, grease, and water. Open a bag of microwaveable popcorn or remove your burger or pizza from its box, and you're likely tearing through paper or cardboard that can't easily burn or become soggy. PFAS keeps us dry in inclement weather, prevents stains on clothing and carpets, and stops food residues from adhering to cooking surfaces. Aqueous film forming foams, which contain PFAS, proved key to

snuffing the blaze that devastated the town of Lac Mégantic, Québec after an unattended freight train carrying North Dakota crude dislodged from its moorings and careened into the downtown core nearly a decade ago.

Despite their life saving role in disaster management and their numerous conveniences, however, PFAS compounds have become increasingly recognized as toxic, with studies linking them to cancer, diabetes, and an array of immune dysfunctions and metabolic disorders. The tendency for PFAS to persist in the human body and the environment, accumulate over time, and climb through the food chain has earned them the moniker of forever chemicals. While older PFAS are being phased out,

concerns regarding new replacement PFAS have also been growing in recent years.

With thousands of variants bearing acronyms such as PFOA, PFOS, PFBS and PFHpS, this group of man-made chemicals presents a veritable alphabet soup. While individual compounds have unique characteristics, there's one unavoidable common factor—the very resilience of PFAS coincides with extreme and unfortunate environmental durability. “The bond between carbon and fluorine is one of the strongest in organic chemistry,” says Sébastien Sauvé, a professor of environmental chemistry at the Université de Montréal. “So the main concern is their persistence in the environment and their tendency to

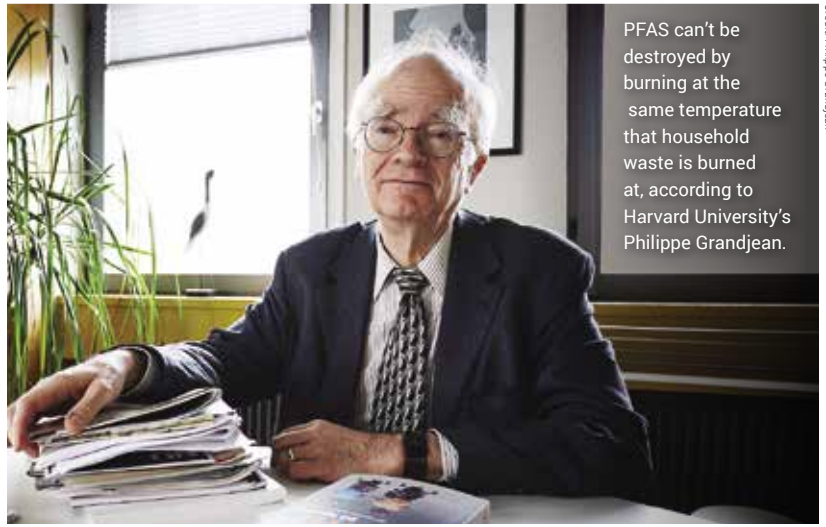


View of the Mont Mégantic from the Lac Mégantic Observatory. Aqueous film forming foams, containing PFAS helped snuff the blaze that devastated the town of Lac Mégantic, Québec nearly a decade ago.



Krista Barfoot, national PFAS technical lead at Stantec and chair of the Ontario Environment Industry Association's PFAS committee, says Canada's advantage is that PFAS haven't been manufactured here.

Credit: Amber Reavley of Sparkside Photography



PFAS can't be destroyed by burning at the same temperature that household waste is burned at, according to Harvard University's Philippe Grandjean.

Credit: Philippe Grandjean

bioaccumulate, especially in species at the top of the food chain.”

Direct risks to surface water itself, including potable water, are relatively minimal, with concentrations usually considered traceable but negligible. “We’ve analyzed drinking water from across the globe and we see it

The very resilience of PFAS coincides with extreme and unfortunate environmental durability.

everywhere, even in bottled water,” Sauv  explains. “But that doesn’t mean that it’s toxic or that the levels are of concern. More that, if you have the right equipment and the right methods, you

can find traces everywhere you look.”

However, there are significant exceptions. Sites close to manufacturing and processing facilities are either undergoing or facing costly cleanups. High risk zones even extend to places where PFAS-laden foams have been used for firefighting. Sauv  says Lac M gantic is the largest known instance of terrestrial contamination from firefighting foams in Canada, with pollution reaching the town’s sewers, adjacent waterways,

and ultimately the St. Lawrence River. Because suppressant foams are widely used in emergency training at airports and military bases, those sites also are often deemed high risk. In July,

for instance, the City of North Bay, Ontario and the Canadian Department of National Defence agreed to the first stage of a military base cleanup projected to last six years and cost more than \$20 million. Contamination is serious enough that DND is providing bottled water to immediate neighbours.

While risks to water depend on proximity to contaminated sites, a much more significant route of exposure is occurring through the marine food chain and impacting not only highly industrialized zones but communities in even isolated regions. Philippe Grandjean, an adjunct professor in environmental epidemiology at Harvard University, says studies in the Faroe Islands, located between Iceland and Norway in the North Atlantic, have correlated steadily increasing levels



PFAS compounds have been found in drinking water around the globe.

of PFAS in young people with higher than average weight gain, autoimmune suppression, elevated cholesterol levels, and risk factors associated with cardiovascular disease and type 2 diabetes.

Given that the Faroe Islands neither manufactures nor works industrially with PFAS compounds, researchers settled on the marine food chain upon which islanders depend heavily. “It’s a fishing nation,” Grandjean says. There’s considerable consumption of pilot whale and other species at the top of a food chain that begins with PFAS-impacted crustaceans and phytoplankton in the St. Lawrence River and other distant waterways, coupled with Gulf Stream enabled atmospheric deposition of microscopic particles from municipal incinerators. “The PFAS just goes up the chimney,” Grandjean says. “You don’t destroy PFAS by burning it at the normal temperature that household waste is burned,

and much of it ends up in the oceans.”

Mélanie Lemire, an environmental epidemiologist with the Université de Laval, works with Indigenous communities in northern Canada on studies evaluating exposures to various chemicals, including PFAS, in order to understand impacts on Inuit health. “The Beluga (whale) is at the top of the food chain and is central to Inuit culture,” Lemire says. “It’s a delicacy rich in nutrients and good fats, so we have to find a tight balance on how to promote these foods, which are central to culture, while trying to better understand and minimize the risks. If the Inuit switch from a traditional healthy diet to a market food diet they would get PFAS from other sources, as food production and packaging could also be a source.”

Lemire says she considers this an environmental injustice, but the kind of international attention needed to chart a new course and enact meaningful change could take time. Krista Barfoot, national

The path forward for municipalities may simply be to monitor and understand what’s in their water system.

PFAS technical lead at Stantec and chair of the Ontario Environment Industry Association’s PFAS committee, says Canada’s advantage is that PFAS haven’t been manufactured here. Thus we haven’t seen the larger scale contamination associated with manufacturing sites in the U.S. However, Barfoot adds, PFAS are imported and used in the manufacturing of other products in Canada so

Canada is not free of PFAS impacts.

This past April, the federal government announced its intent to look at regulating PFAS as a class, as opposed to as individual substances. But Barfoot says there hasn't been much public pressure to develop PFAS regulations in Canada. British Columbia's contaminated sites regulation has standards for just three types of PFAS, while Ontario appears to be waiting for the federal government to decide how it wants to regulate the chemicals. "What we see at the government level in Canada is mostly PFAS monitoring efforts, although there are also site-specific PFAS remediation efforts led by various governments at sites where issues have been identified," Barfoot says.

The path forward for municipalities and other local entities may simply be to monitor and understand what's in their water systems, keeping federal, provincial, and territorial threshold

values in mind. Communities located near PFAS hotspots, meanwhile, might be looking at risk management measures such as those generally applied to brownfields. "If you've got lower levels and they don't seem to be migrating, it may be okay to leave those concentrations in place and continue to monitor what's there over time, and then just target concentrations that can't be safely managed in place for remediation," Barfoot says. She adds that contaminated soil can be removed and incinerated or disposed of off site so long as leachates are safely contained. Philippe Grandjean points out that airborne emissions from conventional trash incinerators are part of the reason PFAS contaminants are reaching the Arctic. Barfoot says a handful of Canadian facilities are equipped to reach the infernal 1,100 degrees Celsius needed to destroy the compounds.

Water treatment is a different

matter. Options include the use of granular activated carbon, which is used to manage a number of pollutants in water treatment systems. However, PFAS simply transfers from water onto these absorbent materials, which then also require careful disposal. In effect, Barfoot says, remedial options continue to advance but remain limited enough at this early juncture and can be costly. "We're getting more and more questions from clients regarding PFAS, so there's a need for more services addressing these contaminants and for the whole technical community to be paying attention as knowledge in this area continues to evolve." *wc*



Saul Chernis is a Toronto-based freelance journalist and frequent contributor to Water Canada.

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Water's Next winners receive a plaque and an individually hand crafted glass pin by artisan glassblower Aaron Calenda of Guelph, Ont.



Credit: Bishop Water Technologies

Bishop Water's septicage receiving facility in Eganville, Ontario continues to be a showcase site demonstrating the economic, environmental, and community benefits of this simple, yet innovative, solution.

Fostering Innovation

What does it take to succeed in the water and wastewater sector?

BY TRISH JOHNSON

AS AWARENESS OF CLIMATE CHANGE heightens across the globe, we are seeing increasingly tighter environmental regulations. Facing this, how then do we continue to protect the environment and mitigate the detrimental effects of our human existence affordably and sustainably?

The reality is, that in the water and wastewater sector, the next great idea or new 'gold standard' is always knocking at the market door as inventors seek to introduce new products and methods. Pioneering activity abounds in the environmental sector in response to a society that is continually raising the bar on its expectations for pollution prevention performance. But new inventions arrive to the market slowly and it takes disruption for the market

to change. To move forward from the current options to the better, faster, cheaper solutions of tomorrow, the experts tell us that the name of the game is innovation.

But what drives innovation? What does it take for new products and technologies to succeed? And why do some ideas thrive, make it to commercialization and go on to disrupt the marketplace, while others fizzle and fail in their early years?

To explore these questions, I reached out to three experts, each with a unique perspective, to capture their insights on what it takes to foster innovation.

Michael Van Belle
President of Adventus
Research + Consulting Inc.

Adventus is a market research and technology assessment company with

The next great idea is always knocking at the market door as inventors seek to introduce new products and methods.

offices in Guelph and Hamilton, Ontario. Van Belle's role at Adventus is to help find the answers needed to make the right decisions by assessing up-and-coming inventions against a full competitive set of comparators. He has learned that all too often the inventor is not objective

and can be blind to challenges or unable to hear constructive criticism. “Nobody wants to be told their baby is ugly,” he says.

Another issue he highlighted is solving a problem that doesn’t exist, rather than addressing a problem that is a known market pain point. His experience has been that “You can’t cure a problem if there is no discomfort. The greatest idea in the world may not matter if the market doesn’t register a need for a new solution.”

Conversely, he noted, “If market pain has confirmed the need for a solution and you have found a solution that can address it, then you just may have a disruptor.”

Van Belle believes it is important to seek input from a range of opinion leaders and key industry stakeholders. However, he noted that the people about to be disrupted “are seldom encouraging of the disruptor.”

What is his advice to eager

innovators? “Don’t stop! Do your due diligence!”

Kevin Bossy

CEO of Bishop Water Technologies

Bishop Water is a Canadian company based in Renfrew, Ontario. It is dedicated to the development of versatile, easy to use, low-energy, and affordable solutions for solids management and nutrient removal.

Bossy responded to my questions about fostering innovation by describing how, in 2008, he set out to solve a problem with a local partner. He told me that initially it took a village. They gathered a large group from the Ontario Ministry of Environment to educate the technical and policy authorities on their concept. Their goal was to get input from diverse perspectives, ranging from approvals engineers to enforcement officials. This group became a sort of an informal consortium offering interdisciplinary advice throughout the product development process.

When asked for his advice to early innovators, Bossy stressed the importance of knowing the target audience and establishing proper comparators. It is also key to clarify the capital costs early on to help get buy-in from the authorities. “You can’t be more expensive, or it just won’t work,” he said.

Bossy noted that his company, like all innovators, is committed to a mindset of continuous improvement. “The iPhone 1 was just the start, right?” Bishop Water has now expanded its portfolio of easy to use, low energy systems, adding BioCord Reactors for biological nutrient removal and ClariPhos Rare Earth Coagulant for phosphorus removal.

Mohammad T. Rayhani

Associate Professor of Civil and Environmental Engineering at Carleton University

As a professional engineer, professor and inventor at Carleton University, Mohammad Rayhani has had first-hand

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experience with the process of developing new products and processes. He is familiar with the early adopter challenges that can occur long before getting to the commercial market. Sometimes even the target audiences don't understand the advantages of a product, or find it too inconvenient to change the status quo.

Fostering innovation *IS* like fostering a child, and sometimes you have to hand over a child to allow it to grow.

"And then, there is always the issue of lack of funds," Rayhani said.

Rayhani recounted an example of an earlier project at Carleton that received initial grant funding. He went through several years of research and development as part of a team collaboration. They progressed through the concept, product

research, lab and field-testing phases, and the results were looking good. Everything was working fine and yet they had difficulty connecting with commercial groups. After 18 months, there was still no company in sight prepared to commercialize the product and more money was needed. "Then I had to reduce my time on the project and that further hindered development," he noted.

That experience taught him that the path to innovation is long and you need to expect changes along the road. Eventually, he had to assign his rights over to others in order to facilitate further commercialization via another avenue. I asked how he felt about this. "Fostering innovation *IS* like fostering a child, and sometimes you have to

hand over a child to allow it to grow," he said.

Closing thoughts

Clearly, the name of the game is innovation. But what these insights from three experts demonstrate is that to be successful, innovation must go hand-in-hand with fostering. For an innovative idea to succeed, it takes nurturing, funding and tending—rather like fostering a child. That long and winding road to commercialization requires a lot of hand-holding. *wc*



Trish Johnson is an independent environmental consultant based in Guelph, Ontario. She has over 35 years experience in the environmental sector supporting public and private clients with planning, management, and project approvals for the implementation of new wastewater treatment technologies.

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Extreme fires can dramatically alter the natural processes of forested watersheds in storing and transmitting water.

Wildfires in our Watersheds

“Code red” for source water supply. BY FRANÇOIS-NICOLAS ROBINNE AND KEVIN D. BLADON

“A CODE RED FOR HUMANITY!” That is how the recently released, landmark report from the Intergovernmental Panel on Climate Change (IPCC) was described. The report, which is the first major review of the science since 2013, clearly indicates that climate change has impacted the Earth’s support systems in ways that are irreversible for centuries to millennia. The consequences of this warming could be catastrophic to humans and society if we don’t act now. The IPCC report strongly echoes the 2019 Canada’s Changing Climate Report and the following 2021 National Issues Report, which detailed what a warmer planet means for the life of Canadians.

In each of these reports, a primary concern is the implications of climate change on the hydrologic cycle and water supply. In brief, the water cycle is accelerating, leading to more water-related climate and weather extremes—droughts, floods, storms, and wildfires. All of these disturbance events are becoming more frequent and more intense.

In particular, catastrophic wildfires have become the unfortunate icon of environmental change almost everywhere in the world where trees and people grow together. Canada is no exception. In fact, the country is a global hotspot, as illustrated by our 2021 record-breaking fire season. Even though wildfires are natural and necessary for Canadian forest ecosystems and, by extension, watershed functioning, the growing scale and intensity of wildfires increasingly poses substantial risks.

It is estimated that Canadian forests provide up to 90 per cent of our surface water supply—as such, the health of our forests is critical for maintaining national water security. Healthy forests filter precipitation, store and release water, hold soils together, and influence local and regional weather through tree water use. Together, these processes provide us with numerous ecosystem services, including river flow mediation, increased water quality, provision of aquatic habitat, and climate regulation.

As such, those living downstream of forests ultimately benefit from access to electricity from hydropower generation, recreational opportunities, and provision of drinking water supplies.

Sustainable and healthy water supplies may actually benefit from the occurrence of smaller, low intensity fires in our forests. Indeed, wildfires can keep vegetation from becoming overstocked, reducing water demand while providing a mosaic of habitats that keep our watersheds healthy. Historically, in many parts of Canada, smaller, more frequent fires were common. However, we have seen a shift in recent years to larger and more intense blazes that can produce many negative impacts on watershed hydrology and outweigh the positive ones.

Extreme fires can dramatically alter the natural processes of forested watersheds in storing and transmitting water and other constituents. For example, fires can lead to more flood events, shifts in the timing of availability of water, elevated occurrence of mass

movements or landslides, increases in sediment, nutrients, carbon, and metals in streams, and decreases in dissolved oxygen. All of these impacts can persist for many years, even decades, after fires, resulting in cascading challenges for recreation, aquatic ecosystems, hydropower generation, and safe drinking water production. In the worst-case scenario these effects become cumulative or compound within a basin, resulting in competition for limited resources—money or water—creating water disruption or shortages.

But the true impacts and costs to water supply across Canada remain largely unknown and understudied. Although it is generally accepted that direct risks to public health from fire-polluted water at the tap are low, they can't be dismissed because the costs to ensure safe drinking water can be substantial. For example, after a fire in a source watershed, costly challenges to water production and distribution can include: failure of the power grid, damages to water intakes and pipes from excess erosion and debris flows, reduced reservoir capacity, taste and odour issues with water, increased landfill costs from treatment

Sustainable and healthy water supplies may actually benefit from the occurrence of smaller, low intensity fires in our forests.

byproducts, and boil water advisories due to insufficient infrastructure. These issues, even though not life-threatening, can be costly and create substantial stress and social unrest, especially when seen as part of a large system where risks accumulate and compound.

The good news is that the future doesn't have to be bleak, and we do have means to mitigate and adapt to increasing wildfire risks to water security. Active forest management practices in source watersheds can reduce the available fuels and potential for high severity fires. Similarly, allowing natural fires to burn during times of low hazard or using prescribed fires can reduce the biomass available to burn in subsequent

uncontrolled wildfires. These practices have the added benefit of supporting carbon sequestration and reducing the vulnerability of our forests, which can protect the health and integrity of Canadian water supplies. Additionally, we must identify those communities whose infrastructure is vulnerable to the effects of wildfire. In those cases, we can then invest in active forest management practices in source watersheds, as well as infrastructure upgrades and operator training to further safeguard the provision of safe drinking water.

To support all of these actions we must fill in the critical gaps that remain in our knowledge. Although the current research allows us to agree on generalities, experts in the field also agree that wildfire-watershed risks are local, maybe regional, in nature and require greater attention. Canada can be divided into 60 different fire regimes, which describes the way fires have burned historically, accounting for seasonality, size, severity, and frequency, among other things. Additionally, across each of those fire regimes may be variable and complex hydrological processes and systems that have not been adequately mapped or understood. Canadian research on wildfire and water can be traced back to the 1980's, but we only started to integrate risks to water supply approximately a decade ago, and most studies have been limited in spatial and temporal scopes. As such, the identification of local risks from wildfires to water supply has been hampered by the difficulties in accessing nation-wide data. It is our hope that continued acknowledgement of the risks combined to stakeholder collaboration and investments in applied research in this area will improve data availability to facilitate a more proactive, rather than reactive, approach to wildfire-watershed risks in Canada.

But the reality is that effective risk management and water resources management requires good governance (read: people), to help support and address the social, technological, engineering, and knowledge gaps and

issues. Water crises on Indigenous land, in North Battleford, Saskatchewan, Walkerton, Ontario, and Flint, Michigan—even though not linked to fire—illustrate the critical importance of effective water governance. As the number of risk factors increase—climate change being a threat multiplier—and the system becomes increasingly complex, the odds for an incident to occur increase as hidden vulnerabilities emerge, and so the risk of water supply disruption. Planning for this reality, no matter how performant the staff is, is paramount, for the very simple reason that we are now navigating in uncharted territories, and we need to prepare for the emergence of 'unknown unknowns' by preparing people to these eventualities. Work done in Australia with staff members from numerous water treatment plants shows that communication, mutual help, and emergency drills are the best ways to manage a crisis when it happens.

So, are we alarmist? Yes, I guess we can say we are, and we stand by it. What happened this year in Canada (B.C., Alberta, and Ontario) and elsewhere around the planet, is nothing normal, but it is a new reality the water supply sector will have to face and dynamically adapt to. We can't only rely on our water distribution (infra)structures to hold the pressure and trust that they will always save the day because these are engineering beauties. But we are not catastrophists. Besides the hope that we will act on climate change and watershed degradation, documented stories from around the world, including in Fort McMurray, Alberta, strongly point at an integrated watershed approach in which wildfires are made a central part of source water protection efforts. We also suggest that "what-if" scenarios, in which a range of issues are simulated, almost anticipated, and a portfolio of risk mitigation options are studied, to become common practice. WC

François-Nicolas Robinne is a Wildfire Research Scientist with the Canadian Forest Service at Natural Resources Canada.

Kevin D. Bladon is an associate professor in Forest Hydrology and Watershed Science at Oregon State University.



Driving Diversity

Increasing diversity can help organizations remain competitive, productive, and profitable. BY SIMRAN CHATTHA

EMBRACING DIVERSITY in the water workforce is more than just a good idea—it is a fundamental necessity.

The water sector employs a diverse range of occupations—including researchers, regulators, policy analysts, manufacturers, and operators—across all areas. At the same time, there is a need to recruit and retain non-traditional candidates—including women and young professionals—that will enable organizations to remain competitive, productive, and profitable.

To do this, organizations need to position themselves as diverse and inclusive employers. However, this is easier said than done.

In August 2020, Water Canada hosted a discussion that explored what the benefits are of increasing diversity and what strategies can be used to recruit a diverse workforce. **Tara Mascarenhas** from Students on Ice, **Geni Peters** from ECO Canada, **Carli Lang** from Water First, and **Gillian Edwards** from Stantec

joined Actual Media’s **Corinne Lynds** for the discussion.

Benefits of a diverse workforce

There are a number of benefits related to increasing the diversity of Canada’s water workforce. These include increased financial performance, creativity, and productivity.

“Stats have shown that businesses that have board made up of a diverse group tend to perform better financially in the long run,” said Edwards. “In addition, when you have the diversity, you end up with more opportunities for creativity and you have different perspectives that come in and make you think outside of the box, which can increase innovation and improve productivity. I think the benefits of a diverse workforce are immeasurable


in terms of your ability to perform and your ability to be relevant in today’s society.”

Hiring and retaining a diverse workforce can also help organizations like Water First run training programs.

“For us, we are training a very diverse group of people,” said Lang. “They come from all sorts of backgrounds and some have learning related challenges. Having staff that can relate to different people really helps us deliver our training.

The benefits of a diverse workforce are immeasurable in terms of your ability to perform.

I would say that it’s absolutely crucial.”
In addition to this, a diverse workforce is enabling Water First deliver its project-based work more effectively.



The water sector employs a diverse range of occupations. At the same time, there is a need to recruit and retain non-traditional candidates that will enable organizations to remain competitive, productive, and profitable.

“For some projects, certain staff shine as the ones that really get the key to that particular group,” added Lang. “For other projects, it’s a completely different set of staff. I think it allows us to do our job better and to reach a broader group of individuals.”

Recruiting a diverse workforce

One of the challenges that’s come is that some companies aren’t aware of where they can recruit staff from diverse backgrounds. Naturally, the next question is: what strategies can these companies for recruitment?

“For Blue Futures Pathways, we have a job board that is free to use,” stated Mascarenhas. “We are promoting the job board among diverse employers and we are seeking out diverse jobs across the country. In addition to this, we are encouraging diverse youth to apply to the jobs that are posted.”

“I think looking for a diverse workforce also means asking who do you partner with and where do you ask?” added Mascarenhas. “Traditionally, Students on Ice uses its social media channels and other channels when it’s recruiting. But contacting other organizations,

like newcomer organizations and Indigenous organizations, and putting the information in front of the right people in those organizations can be valuable.”

A key takeaway is that it’s important to meeting people where they are at. For example, universities can be good partners if you are looking to recruit students. Part of this process includes getting the information to the right people at the relevant organizations so that they can share job postings within their networks.

Reaching people is only on piece of the puzzle. We also need to consider what is included in job descriptions.

“Apparently, when people see job descriptions, men will apply for a position if they meet around 60 per cent of the criteria,” explained Mascarenhas. “In contrast to this, women will not apply for the job unless they feel like 100 per cent of the criteria. When you’re recruiting, think about what is really essential. Maybe there are things in the job description that are not essential but rather are nice to have.”

Individuals posting jobs can consider the type of language that is being used. Mascarenhas noted that resources have shown words like “analyze,” “determine,” and “expert” are male-dominated words. In contrast to this, job descriptions that include words like “collaborate” and “support” tend to attract more female candidates. Carefully considering the language that is used in job descriptions can make them more inclusive.

“I liked what Tara said about checking your assumptions, how you’re writing the job posting, and what you’re looking for,” remarked Lang. “What does it really mean if you’re including things like ‘ability to work in a fast-paced environment?’ I feel very lucky to work for an organization that is flexible and recognizes that everyone comes with a different type of life. What we’ve tried to think about is how we review credentials, in addition to looking at who individuals are and

what they bring to the organization in a broader more holistic way, rather than just looking for a graduate degree or whatever it might be.”

In the case of ECO Canada, its found that it has a more female-oriented workforce because it operates in the not-for-profit sector. However, the organization has made an effort to recruit a more diverse workforce.

“We’ve looked at ways to convey the importance of a mindful and respectful work environment,” emphasized Peters. “That allows us to attract individuals from more diverse backgrounds. It’s sort of a cycle. We have a diverse workforce in our organization and that’s in part because we started off with a female-oriented leadership team.”

All in all, organizations can consider where they’re recruiting, along with what they’re including in job descriptions, when trying to attract individuals from diverse backgrounds. wc

Simran Chattha is the editor of Water Canada.

CANADA'S WATER WORKFORCE DIVERSITY

We asked attendees about the biggest challenge related to increasing diversity in Canada's water workforce. Here's what they had to say:

Diversity can trigger defensiveness
41.2 per cent

Effects of diversity training might not last
0 per cent

Diversity might disrupt group cohesiveness
0 per cent

Other 58.8 per cent



Modern Data Management

What are the key elements for overcoming challenges related to water data management? BY ERIK LARSON

WE ARE THREE YEARS INTO the United Nations Water Action Decade 2018-2028. While the water industry has already come a long way in transforming how it manages water, the journey is far from over. Governments and water organizations recognize that they need a firm understanding of every part of the water ecosystem and water management lifecycle to affect real change. To do this, they are investing in all aspects of data, from collection to management, data quality to analytics, and transparency to accessibility. Data is being shared both internally and externally, with the public, and with global scientists.

Technological advancements have created an explosion in data. However, government agencies and water organizations are in various stages of

maturity in collecting and analyzing information from a variety of applications including:

Drinking Water: By bringing together data from all treatment facilities, lab testing results, and compliance regulations, organizations can ensure safe drinking water for everyone.

Stormwater: Using data collected from reservoir levels, stream-flows, and rainfall, environmental organizations can take preventative action against flood dangers.

Wastewater: Managing a highly regulated resource such as wastewater effectively requires accurate data, advanced record computation, and sophisticated analysis.

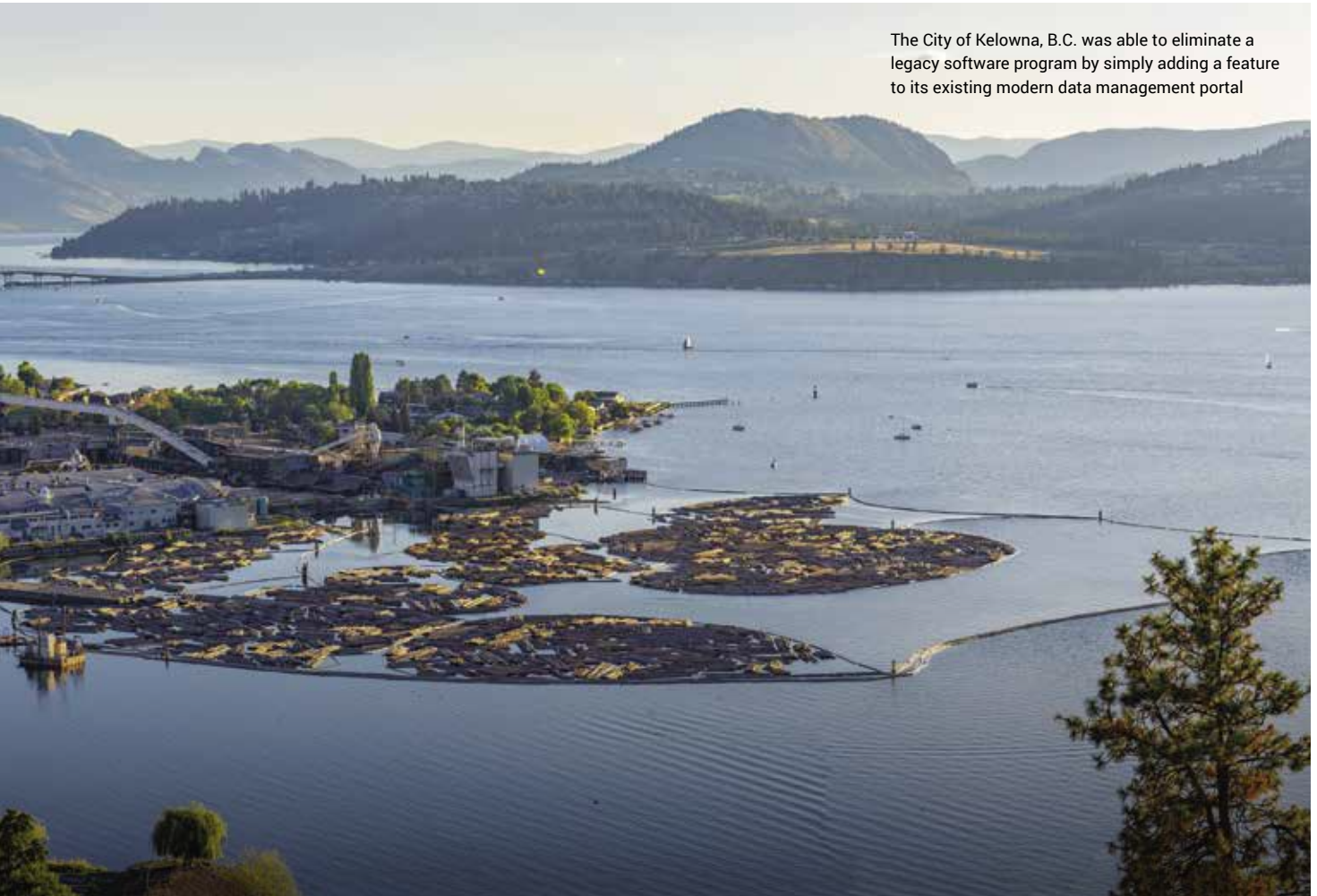
There are still two prevalent problems in water data management today.

Problem #1: Siloed information

The data gathered from different water management applications or through manual/offline methods often lives in silos across state and local government and industry organizations. Even within the same city or public works department, valuable, actionable information for water managers may not be readily available.

For instance, a water utility that still relies on a paper-based system or spreadsheets to collect, track, and manage its sampling data makes it almost impossible to share water quality insights with other organizations in the region. Even if there is a regional or provincially-

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run environmental monitoring agency that monitors the same watershed, the ability to integrate those insights or data is substantially hindered. A water quality

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issue in one region is often likely to have a cause or effect on a neighboring region or department.

Problem #2: Lack of analytical tools

Other organizations have lots of data but lack the ability to glean insights from that data—they are ‘data rich’, but ‘information poor.’ Without proper tools that can organize, correlate, and compare data, in-depth analysis is not

possible meaning water managers are missing out on information that could be critical. The very purpose of collecting data is so that you can act on it.

To make the most of data we need to break down the silos and use modern data management tools that use secure cloud native infrastructure with rich data analysis. Here are four key components to optimizing data.

Component #1: Consolidate data

Many government agencies are entrenched in legacy systems which can make it hard, if not impossible, to examine data from sources alongside one another. Understanding the relationships between consolidated water data sources is powerful. It can

unveil insights that would never be found otherwise and offer correlations that can be used to test new hypotheses about the cause and effect of different water activities. Alone, trends may not raise an alarm. When read together though, they can indicate things like pollution from agricultural runoff or predict the risk of flooding with an approaching weather system.

Kootenay Watershed Science (KWS) is an excellent example of a small community taking data consolidation into its own hands. In 2012 a tragic landslide led to the realisation that there was sparse data to understand the Kootenay watershed. KWS was formed to monitor snow, streamflow, and climate conditions in the Johnsons Landing area to better understand the hydrologic regime that contributed to the 2012 landslide and identify signals that may indicate an increased risk of slides in the



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future. Today KWS uses a combination of professional hydrologists and volunteer citizen scientists to collect data and maintain a monitoring program using modern data management software.

“Once we began looking at all our data in the new data management program, we were able to see everything in such detail and it was easy to find errors and correct them,” said Paul Sasso, hydrologist at KWS. “It drastically improved the quality of our data as well as our understanding of our hydrometric sites.”

By automating quality assurance and quality control activities, KWS now has greater confidence in sharing this information with researchers, local governments, and education partners.

Component #2: Dive into deep analysis

Water utilities can struggle to get real value from the data at their disposal. IT teams (business intelligence and/or data science teams) need to team up with managers across the organization to identify what would be the most valuable analysis to have. Different departments

will have different needs. For example:

- Water utilities may ask questions to ensure they have access to clean drinking water.
- Water purveyors may ask questions to understand water loss within the system.
- Environmental agencies may ask questions to find solutions in extreme weather scenarios.

Good data creates demand for good information. In other words, once you know what you can know, you will want to know more.

The City of Ottawa has over 100,000 test results coming in from several different sources internally as well as external labs every year. In 2005, the City migrated to a new modern data management system to make it easier to acquire, access, and process its data. With so much information, the opportunity for deep analysis is great and the City is able to make informed decisions and provide transparency across the organization. Having

historical data easily accessible and in a variety of different views makes it easier for the city to identify trends and better plan for the future. Having the data centralized also helps the city keep an eye on compliance. If there is an issue or missing data from a sensor, it is picked up right away so the operators can bring the system back into check.

Component #3: Share knowledge across the organization

Sharing knowledge across the organization is easier than it has ever been with online portals. Today, departments across the organization can have real time access to quality-assured data. Knowledge is power; whether you are a front-line worker or the mayor, you have a role to play in events like flooding or water contamination. Online portals are designed to be user-friendly with modern graphical interfaces that allow for quick visualisation of water data through maps, data grids, and charts. Stakeholders can overlay a series of data giving different users different levels of information. Online portals allow



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different departments to access data that would normally require an information request. For example, the person who needs to file the compliance report can easily extract and download the data they need to complete a filing.

The City of Kelowna, B.C. was able to eliminate a legacy software program by simply adding a feature to its existing modern data management portal. The new tool is essentially a customized

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template that enables the generation of a monthly report for the Ministry of Environment. This changed a weekly task from hours to minutes and eliminated the need of training an employee for that task and the cost of running a legacy software program. Having a centralized cloud native platform enables the entry of data, and use, by whoever needs it

within the organization, whether it be for tracking, reporting or analysis.

Component #4: Share knowledge externally

Sharing data will help us identify the industries and communities that use water well, and those that don't. This knowledge sharing can go a long way to establishing best practices and forming helpful water regulations.

Water Survey Canada operates over 2,800 hydrometric gauges and is the largest collector of water data in Canada. Today WSC uses modern cloud data

management technology to interpret and disseminate information to provinces, territories, and other agencies across the country. WSC is also part of global data sharing with organizations like UNESCO International Hydrological Programme, World Meteorological Organization, the International Joint Commission,

and others. Scientists know that the more data you have from different sources, the better, but the quality and analysis of that data is where the true value lies. Due to a large number of agencies and people depending on WSC data, keeping it accessible and accurate in near real-time will always be a top priority.

Community outreach is an important component of any research discipline and much of data collection is effectively research. By sharing real time environmental conditions and their related consequences without politics, just the facts, brings a new level of transparency to climate change. Deepening the public understanding of how intricately our ecosystems are connected makes us all accountable when it comes to adapting our behavior to sustain the planet. WC



Erik Larson is a digital solution expert with Aquatic Informatics.

APPOINTED



TYLER SCHULZ

Ontario Auditor General **Bonnie Lysyk** announced that **Tyler Schulz** has been appointed as an assistant auditor general, assuming the duties of commissioner of the environment. Schulz has held the role as an acting assistant auditor general, commissioner of the environment, since February 1, 2021.

“Dr. Schulz has done outstanding work and his experience and leadership will ensure our Office’s environmental reports continue to make impactful recommendations,” Lysyk said. She added that as commissioner, Schulz leads audits with the priority of holding the government accountable for its responsibilities under the *Environmental Bill of Rights*, 1993 and for provincial programs intended to protect the environment.



CAROLINE METZ

Caroline Metz has joined the Intact Centre on Climate Adaptation as the new managing director of economics and resiliency.

Metz has over 20 years of project leadership experience working with organizations in the public and private sectors in Canada and the United States to solve complex business problems and implement systemic change. Her project leadership experience makes her well positioned to demonstrate the business case for climate adaptation across Canada.

Prior to joining the Intact Centre on Climate Adaptation, Metz held management consulting roles at Ramboll (formerly ENVIRON),

PricewaterhouseCoopers, and Deloitte. She also led the strategic planning and implementation of innovative healthcare programs at Sinai Health and Cancer Care Ontario.



DAWN DALISAY

FER-PAL Infrastructure has appointed **Dawn Dalisay** as its vice president of finance. Dalisay will be leading FER-PAL’s finance department with responsibility for all corporate budgeting, financial reporting and cash management, among other finance and accounting duties.

Dalisay bring 19 years of industry experience to the role. She previously served as FER-PAL’s director of finance. Before joining FER-PAL, Dalisay spent over four years at WSP Canada and the MMM Group in several positions, including the director of finance for WSP’s Transportation Division. Prior to WSP, Dalisay worked at AECOM as its district finance manager for Ontario.

“I look forward to taking this next step with FER-PAL to further the development of FER-PAL’s practices to ensure its growth while maintaining its position as a North American leader in sustainable water solutions,” said Dalisay.



DAVID DANIELS

David Daniels has joined Carl Data Solutions as the vice president of Environmental Monitoring as a Service (EMaaS) Sales.

“David is a proven large enterprise solution executive who is tasked with building a sales pipeline for our AI and Machine Learning-enabled

environmental monitoring technology,” said **Jean Charles Phaneuf**, CEO of Carl Data Solutions. “The global climate crisis necessitates that large industrial companies and government institutions prioritize the ‘E’ in Environmental, Social and Governance (ESG) mandates.”



ANN MULVALE

The Walkerton Clean Water Centre (WCWC) has announced the appointment of **Ann Mulvale** and **Mitch Twolan** to the board of directors. The WCWC now has a full complement of 12 directors.



MITCH TWOLAN

Mulvale has served her community in a variety of volunteer, elected, and leadership capacities.

Previously, she served as mayor of the Town of Oakville, councillor of Halton Region, and president of the Association Municipalities of Ontario.

Mulvale has also served on the boards of directors of the Federation of Canadian Municipalities and the Ontario Municipal Employees Retirement System and as an executive director of Oakville United Way.

Twolan is currently the mayor of Huron-Kinloss. He began his political career as a councillor for the Township of Huron-Kinloss before being elected as deputy mayor in 2004 and mayor from 2004 to present. He was elected warden of Bruce County for several years.

Twolan serves on a number of boards of directors: Great Lakes St. Lawrence Cities Initiative; Grey Bruce Health Unit; Saugeen, Grey Sauble, Northern Bruce Peninsula Source Water Protection Committee; Southwestern Integrated Fibre Technology (SWIFT); and, Westario Power. WC



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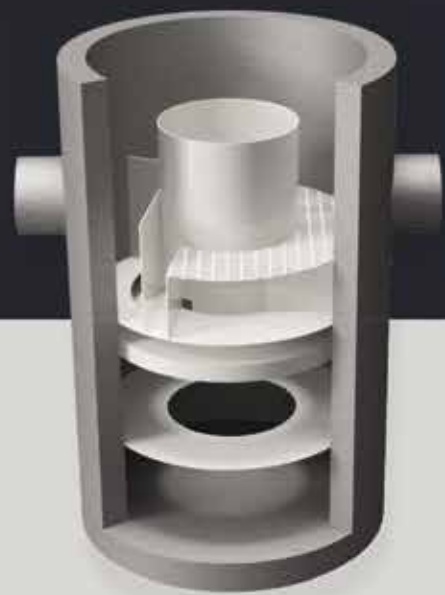
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