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BY WATER CANADA

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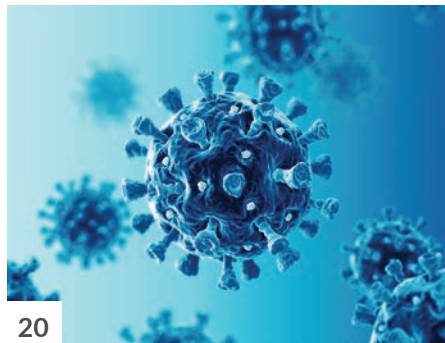
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### June 1-3

Canadian Water Summit  
WATERSUMMIT.CA

### June 2

Water's Next Awards  
WATERSUMMIT.CA/WATERS-NEXT

### August 17

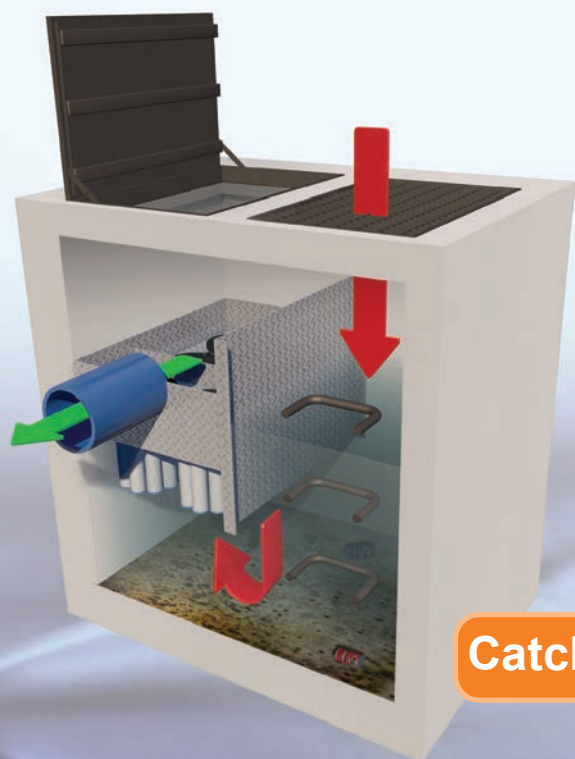
Blue Economy Webinar:  
What's Up With PFAS?  
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## Watershed Moments

BY JEN SMITH

**WHEN I WAS IN UNIVERSITY,** I took a course on Buddhism. I was fascinated by the peace, the tranquility, the way nature was honoured, even long before I knew to honour it myself. One evening, while I was sitting in the small classroom, a fellow student knocked over her uncapped, and still quite-full, bottle of water. It poured out across her desk and onto the floor, where the water formed a silky ribbon that wound its way across the uneven wooden planks in a brave attempt to outrun its inevitable fate.

The professor stopped his lecture mid-sentence, silently watching the water's journey of hope across the classroom with a look of fascination on his face. After a few moments he spoke, saying, "See how the water escaped from the bottle, splashed onto the desk, and is now running along the floor? Where will it go from here?"

"If we were to wait long enough," he said. "We would see the water seep through the floor to the subfloor beneath, and so on, until it would eventually meet up with the water that runs under our feet."

He then turned back to his notes, shuffled them briefly, and said with a quiet awe, "Water will always find a way to return to itself."

It was what you might call my watershed moment.

Even two decades later, whenever it rains; whenever I see the rushing of the river near my home heavy with spring thaw; I think to myself: there goes the water, returning back to itself. The insight, like water itself carving new pathways out of immovable mountains and filling the miniscule spaces left by grains of sand, has somehow permeated my very consciousness, changing me in ways that makes me feel small and insignificant, inspired and hopeful.

And of course, now that I live and breathe water for a living, I find myself reminiscing on the words of that professor more often. Especially as I get to the part of the editorial process when I pull together all the articles for an upcoming issue and do my best to assemble them in a way that tells a story. And I have to admit, I've been amazed at the way in which they manage to find cohesion, even when the stories seem so disparate. Whether it's an article about managing water sustainability (pg. 12), innovations in water like the Riparian Web Portal (pg. 27), improvements to anaerobic co-digestion (pg. 30), or monitoring our health in wastewater (pg. 20), the content on those pages will inevitably mingle together, their underlying similarities melding to become an ocean of words that run across my desk and onto the floor, where they'll eventually seep into the area rug, then the subfloor, and so on. Because after all, water will always find a way to return to itself.

What is your watershed moment? [wc](mailto:wc)

Jen Smith is the editor of Water Canada.  
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WaterCanada



**RAY FUNG**  
Ray Fung is a founding member and Director for the Partnership in Water Sustainability in BC. PG.12



**TIM PRINGLE**  
Tim Pringle is the founding Director and leads the Ecological Accounting Process initiative for the Partnership in Water Sustainability in BC. PG. 12



**KIM STEPHENS**  
Kim Stephens is the Executive Director and the water resources engineer-planner for the Partnership in Water Sustainability in BC. PG.12



**CONNIE VITELLO**  
Connie Vitello the editor of EnvironmentJournal.ca. PG. 20

ABOUT THE COVER

What gets measured gets managed. Protecting our water means investing in programs and new ways of thinking. Read more on page 32.

Coming up in the next issue:  
**JULY/AUGUST**

**Thermal Mitigation of Stormwater**



**The Role of Wetlands**



**Protecting Our Source Water**

PLUS: Columns, news, and insights, coverage on the industry's biggest events, people on the move, and more.

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To reach Water Canada's influential readers in print, contact Jackie Pagaduan at 416-444-5842 ext.0112 or jackie@actualmedia.ca



Source: Toronto Metropolitan University

The **Nicholas Reid Memorial Award** has been established in the memory of Nick Reid. Nick was Executive Director of the Urban Water Research Centre and championed the university's efforts to achieve a healthy and sustainable urban water cycle. The Award is given annually to a Toronto Metropolitan University graduate student in financial need who demonstrates leadership or innovation in a water-related area.

The inaugural recipient of the Nicholas Reid Memorial Award is Zanina Ilieva!

Zanina is a PhD student in the Civil Engineering Program at Toronto Metropolitan and is working on the removal of per- and polyfluoroalkyl substances (PFAS) from wastewater. PFAS are toxic to animal and human

health, yet they are not properly removed from wastewater treatment plants and subsequently flow into the environment. Zanina is working on a treatment technology that can sustainably and cheaply remove PFAS and therefore contribute to a cleaner safer world.

Zanina has an A+ grade point average and has completed internships in the Netherlands and Australia. She participates in the university's Graduate Teaching Development Program, is a volunteer lecturer in the SHAD program, and received best presentation awards at both CAWQ and IWA conferences. Zanina has demonstrated great initiative in the lab and in her research and is part of the Ontario Water Consortium's Graduate Leadership Council. [wc](http://www.wc)

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

Email Water Canada's editor Jen Smith at [jen@actualmedia.ca](mailto:jen@actualmedia.ca)



# Five long-term drinking water advisories lifted in Mohawks of the Bay of Quinte First Nation



Chief R. Donald Maracle and the Honourable Patty Hajdu, Minister of Indigenous Services, celebrated that five long-term drinking water advisories have now lifted in Mohawks of the Bay of Quinte First Nation, thanks to newly built connections to their water treatment plant. The advisories had been in effect since 2008 on five water systems in the community. They were lifted after the First Nation extended its water distribution system, connected the buildings to the system and decommissioned the existing systems.

The new connections to the water distribution system provide clean and reliable drinking water to approximately 280 homes, 20 semi-public buildings and 756 community members. Water flowing to these buildings through the distribution system meets all current federal and provincial drinking water requirements.

One boil water advisory will continue for the Public Works Garage, which will be resolved through future water distribution phasing under Infrastructure Canada's Disaster Mitigation and Adaptation Fund.

The First Nation and Indigenous Services Canada have invested \$58 million since 2014 to improve access to clean drinking water in the community,

including the construction of a new water treatment plant, a water tower and extensions to the community's water distribution system.

"The completed Phase III \$19.5 million Waterline Project provides support for our residents to have full access to a dependable and safe drinking water supply. Improving access ensures the health, safety, security and economic well-being of our community, which is so vital to our residents.

"We are extremely pleased on the progress made in partnership with Indigenous Services Canada and express sincere thanks to Prime Minister Justin Trudeau; the Honourable Patty Hajdu, Minister of Indigenous Services; the Honourable Marc Miller, former Minister of Indigenous Services; Anne Scotton, Regional Director General, Ontario Region; and the entire Indigenous Services Canada project team for their support to realize this project. We look forward to future waterline projects slated for 2023. We are grateful to our MBQ infrastructure team and all contractors who worked diligently throughout the COVID-19 pandemic to successfully complete this vital project." *Chief R. Donald Maracle Mohawks of the Bay Quinte First Nation. wc*

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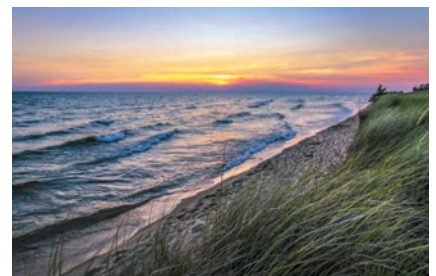
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**NEWS:** USask report identifies sectors putting freshwater at risk  
<https://bit.ly/freshwaterrisk>



**NEWS:** Canada invests in sustainable water infrastructure for Iqaluit  
<https://bit.ly/infraiqaluit>



**NEWS:** GLEN calls for strengthened commitment to water quality  
<https://bit.ly/greatlakesquality>



**NEWS:** Flood-affected B.C. communities benefit from recovery funding  
<https://bit.ly/bcfloodfund>



# A Place to Grow

Experts weigh in on Ontario water BY WATER CANADA

**AS THE ONTARIO ELECTIONS LOOM LARGE** on the horizon, *Water Canada* took the opportunity to ask water industry experts to weigh in on what they think the biggest water issue is that the next Ontario government needs to focus on. It's probably not surprising that the answers were varied, well-considered, and, of course, inspiring.

What do you think the biggest water issue Ontario needs to address is?



**PATRICK MCMANUS**

## Infrastructure

"The OSWCA believes in sustainable water and wastewater systems across Ontario. Unfortunately, much of Ontario's core infrastructure

is in urgent need of rehabilitation and replacement. The Financial Accountability Officer of Ontario estimates that the current municipal infrastructure backlog is about \$52 billion. This would be the cost to bring municipal assets that require capital spending into a state of good repair.

Buried infrastructure is often 'out of sight and out of mind' to the public, and even elected officials. OSWCA believes investment in water and wastewater systems shouldn't be political, we believe the sale of water should be priced to offset the cost of system maintenance and expansion."

- Patrick McManus, Executive Director, Ontario Sewer and Watermain Construction Association



**SUSAN LIVER**

"There are so many competing priorities in the supply, collection, and management of water in Ontario including:

- Emerging contaminants of concern in both water supply and treated wastewater discharge ranging from microplastics to per- and poly-fluoroalkyl substances (PFAS);
- Effectively leveraging Big Data from operating systems and assets to inform targeted and effective investments;
- Investing in people to operate and maintain our systems, recognizing loss of institutional knowledge with retirements and increased job mobility, as well as the need for training as facil-





areas with combined sewers. In addition, changing climate affects can affect the efficiency of building systems, expected service life of structures, and alter source water quality for potable systems. Tools to assess climate impacts, like the Public Infrastructure Engineering Vulnerability Committee (PIEVC) High Level Screening Guide, must become part of designing any infrastructure investment.

This is not a question of weighing risk against cost. Planning and investing in resilience now avoids expensive responses to future emergencies created by conditions that are not just probable, but inevitable.”

-Susan Liver, P.Eng., PMP, is a Business Leader for Eastern Canada in Stantec's Water Business Line



NADIA  
TODOROVA

“Water infrastructure in Ontario has a significant leakage problem that is creating costly inefficiencies in water systems across the province. Developing a new approach to funding strategies to mitigate this issue will be crucial to realizing improvements.

A 2021 RCCAO commissioned study found that municipalities across Ontario on average lose 10 percent of the system's capacity to leaks, while some towns and cities leakage rate can be over 40 percent. Leakage issues in infrastructure system contribute greatly to increased costs and greenhouse gas emissions, because a lot more energy is needed to push enough water through the system to meet demand in what is already a very energy-intensive process.

To maximize the impact of water infrastructure funding, a continued focus on asset management planning is needed. The past few years have shown that sustained attention and investments in infrastructure asset management and rehabilitation are the more cost-effective options. Inadequate investments deteriorate assets further and only exasperate future funding needs, hinder economic and environmental progress, reduce service quality, and erode the value we created in our assets.

Over the last several years, Ontario municipalities have developed better

water assets and more detailed knowledge about managing water systems than ever before, but challenges remain in many parts of the province. While the scope of the problem varies, the challenges faced by are fundamentally similar in nature. Small municipalities often do not have a tax base large enough to fund infrastructure projects, while large cities like Toronto have massive systems with an exponentially greater number of areas where problems may arise. Therefore, it is imperative that provincial funding continues to be provided to address ongoing improvements to water infrastructure.

-Nadia Todorova, Executive Director, Residential and Civil Construction Alliance of Ontario



RALPH  
PENTLAND

### Environmental action and legislation

“As the next Ontario government enters its new mandate, it will be faced with enormous challenges related to climate change impacts on water and wastewater infrastructure, and on aquatic ecosystems and human health.

For example, what used to be a 100-year storm event can now be expected to occur several times every 50 years. Insurance risks, sewer designs, stormwater management systems, and zoning based on flood risk will all have to adjust to this changing reality.

With higher water temperatures, dissolved oxygen will be reduced in lakes, rivers, and reservoirs. Pollution from land use will be amplified by projected increases in precipitation intensity and longer periods of low flow. Increased pollution coupled with increased temperatures will result in massive blooms of harmful algae and bacteria.

Climate change is also impacting on human health in several ways. Climate-driven infectious diseases are increasing. Water security in remote communities, especially Indigenous communities remains a serious challenge. And vector-borne diseases such as the West Nile virus and Lyme disease are increasingly prevalent further north.

The incoming Ontario government

ities become more computerized (see Big Data comment above); and

#### ● Aging infrastructure

However, the item which should be the biggest priority for the provincial government is supporting the modification of our systems to provide resilience to climate change. This permeates every aspect of the water industry from design standards that consider more intense rainfall and higher seasonal temperatures, to hardening of existing infrastructure to withstand future climate conditions. The province recently announced an investment in building, upgrading, and rehabilitating storm and wastewater infrastructure. This is an important investment as peakier storm events overwhelm existing sewers and result in sewage entering the environment in

will be facing all of these challenges at a time when its capacity to deal with water and environmental issues has been seriously diminished. During the 30 years of legislative activism since Ontario enacted its Environmental Bill of Rights in 1993, environmental program budgets have been cut in half while overall governmental spending doubled in constant dollars.

That trend cannot continue. Ontario citizens expect and will demand better.”

— *Ralph Pentland, Member of the Forum for Leadership on Water and former Director of Water Planning and Management in the Canadian federal government.*



LAURA REINSBOROUGH

“When we care for and invest in our waterways—wetlands, peatlands, headwater rivers, lakes and more—we are more resilient in the face of climate change. We make

great strides in protecting biodiversity. We enable clean drinking water. We preserve traditions and, when done properly, we uphold Indigenous rights. Protecting our waterways is the single biggest water issue for our next government to embrace.

When I say protecting, I mean there

eroded. In so doing, we prioritized the needs for development and resource extraction over the protection of waterways, sometimes even pitting freshwater protection against providing sufficient housing options. It is a fallacy that these needs cannot all be met; good legislation is a tool to ensure that they can. Because of changes to legislation, we can expect altered flooding regimes and intensity of peak flow, the removal of important riparian habitat and degradation of water quality, and even less protection for species at risk within Ontario.

Protected waterways are good for Ontario in many, many ways. This is clear from British Columbia, where the economic impact of protecting and enhancing watersheds is valued at \$5 billion annually. Ontario can embrace this, too.”

— *Laura Reinsborough, CEO, Ottawa Riverkeeper*



MARK MATTSON

### The Great Lakes

“Right now, no matter if you’re a politician, business owner, resident, or visitor to Ontario, the biggest water issue is

water monitoring and sharing of data as the way forward to better connect people to the water’s edge. As we start the UN Decade of Ecosystem, helping communities foster a relationship with their waterbody, is the greatest form of restoration and protection.

All of this starts with a push to create more access to swimmable, drinkable, fishable water for everyone.”

— *Mark Matson, President of Swim Drink Fish, Waterkeeper for Lake Ontario, a water quality advisor to the International Joint Commission, a board member for the US-based Waterkeeper Alliance, and a member of Ontario’s Great Lakes Guardians Council.*



BERNADETTE CONANT

### Prioritizing water

“The biggest water issue to be addressed is not a problem but an opportunity; the recognition and leveraging of water as a central opportunity to

forge progress.

Ontario, along with Canada and the world, is experiencing and managing the impacts of many major challenges like climate change, shifting population distributions, and declines in biodiversity and ecosystem health. While these challenges are often regional, national, or international in scope, their impacts are acutely felt and experienced at the local level — and the best solutions are frequently regional or local as a result.

There is an opportunity for the next provincial government to leverage the vital role water plays to make progress on shared challenges for our communities. Water management is at the heart of many complex challenges and alignment around water management can support our collective health and well-being through their links to water within urban and rural working landscapes, as well as protected and natural areas.

Given the central role water plays in the prosperity of communities, Canadian Water Network believes that water organizations are natural leaders for making progress on shared challenges. Water organizations have positive impacts within and beyond their communities, so approaching their support as anchors for community building is a powerful

## The biggest water issue to be addressed is not a problem but an opportunity; the recognition and leveraging of water as a central opportunity to forge progress. - Bernadette Conant

is more that can be done beyond setting land or waterways aside for conservation purposes. I mean restoring and enacting legislation that has been designed for the purpose of protecting our waterways. I mean ensuring solid data collection so that decision-makers at every level have the evidence to support informed decisions. And I mean a public, young and old, that is informed and engaged on the issues affecting their local waterways so that they can actively contribute to their care and protection.

As Canada’s most populous province, Ontario shirked its responsibilities to water by allowing our legislation to be

the Great Lakes. As the world’s largest freshwater reservoir, it’s home to over 40 million people, which makes it our greatest drinking water source. Protecting it should be imperative.

This year, 2022, we’ll be celebrating the 50th anniversary of the Great Lakes Water Quality Act, which coincides with our neighbours to the south also highlighting the 50th anniversary of the Clean Water Act. Making 2022 a big year to look back at what we’ve achieved in protecting our greatest resource, while also looking ahead to what needs to continue.

In that future, we see it crucial that more community science-based



opportunity to achieve more effective prioritization of actions and investments.”

— Bernadette Conant is the CEO of Canadian Water Network



KIM GAVINE

“Ontario’s 36 conservation authorities understand the value of water and how it’s connected to what we do in our daily lives. The biggest challenges we see on the horizon, that have the potential to threaten Ontario’s water quality and quantity, are the impacts of climate change and rapid urbanization.

As watershed-based resource management agencies, integrated watershed management is at the core of everything conservation authorities do. Watershed management is a proactive measure, which can help us face current and future challenges to potential threats, while effectively supporting growth and development opportunities for the people of Ontario.

Conservation Ontario and conservation authorities’ concerns around water are focused on flooding (including aging infrastructure) and droughts, drinking water sources, watershed streamflow, stormwater management, and rural runoff. Updated watershed science and continued support for conservation authority programs and activities such as natural hazards management, watershed stewardship, source water protection, ecological monitoring and reporting is much needed to protect our precious water resources and combat these concerns.

Ontario’s strong watershed science has been built through the combined efforts of local, provincial, and federal scientists, and other experts. Through this science, effective policy is established to safeguard water resources, protect our farmland, improve water quality in the Great Lakes and ensure safe and sustainable water sources.

This results in safe and plentiful drinking water, lakes, and rivers in which we can swim and fish, as well as healthy soils, growing forests, and protected wetlands, and ultimately healthy ecosystems for us all to live and play in.

— Kim Gavine, General Manager, Conservation Ontario



KATHY VASSILAKOS



CHERYL BEAM

“Since the March 2019, Health Canada release of a revised lead guideline (with a new lower) limit of 5ug/L for lead in drinking water there has been no policy or regulatory response by the Ontario government. So, despite the current suite of lead control measures in place in Ontario, the health risks to water consumers (and particularly vulnerable populations) from lead in drinking water remain, with no apparent end in sight.

OMWA launched a 3-part webinar series in May-June of 2021 focussing on the issue of lead in drinking water and followed up with an online survey to gauge interest in remedying this situation from Ontario water professionals.

Given the importance of the lead file to our informed membership, the OMWA believes that the single biggest water issue that the next Ontario government needs to address is to reduce health risks to water consumers by eliminating all lead service lines in Ontario while ensuring exposures to the population are at or below the Health Canada’s recommended lead drinking water standard during the elimination period.”

— Kathy Vassilakos, OMWA Vice President, City of Stratford Councillor & Co-Chair of Lead Working Group and Cheryl Beam, OMWA Board Member, City of Greater Sudbury & Co-Chair of Lead Working Group



LYNETTE MADER

## Watershed management

“We believe that the dual crises of climate change and biodiversity loss needs to be a top priority for all Canadians. We also believe that wetland conservation and integrated watershed management can serve an important role in mitigating these issues. Natural infrastructure can provide critical wildlife habitat while offering flood attenuation benefits and a host of other positive outcomes from improved water quality to carbon sequestration. In order to accomplish this, we need a comprehensive wetland policy and to update our land-use planning guidance. We recommend modernizing the Ontario Wetland Evaluation System (OWES) to

include greater consideration and weighting around regulating eco-system services, particularly as it relates to climate change mitigation and adaptation. We would also like to see the implementation of a provincial framework for wetland offsetting that ensures the protection and upstream integrity of priority wetlands based on an inclusive evaluation and considers the entirety of the impact when evaluating compensation towards a goal of net ecological gain.”

— Lynette Mader, Manager of Ontario Operations, Ducks Unlimited Canada



MELANIE DEBASSIGE

## Clean drinking water

“Indigenous peoples across Canada have an inherent right to clean drinking water, yet as of April 2022, there are 41 First Nation communities

on drinking water advisories in Ontario alone. Many factors contribute to the existence of these long-term boil water advisories such as ongoing maintenance of the water treatment plants, difficulty obtaining parts when they become broken or old, lack of available water operators in the community, and much more.

The reality is that there is no band-aid solution or one size fits all approach to lifting the advisories. At the Ontario First Nations Technical Services Corporation, our Circuit Rider Trainer, and HUB Programs work on training First Nations Water Operators across the province, as well as providing operator assistance to 22 communities that are not affiliated with a Tribal Council for technical support.

Through the work we have been doing with our Circuit Rider Trainer Program (CRTP), we’ve been able to help First Nations water operators upgrade their training and maintain their licenses to operate the water treatment plant in their communities. With OFNTSC’s Engineering service, our HUB program has been able to assist with lifting 4 long-term drinking water advisories since 2020. We anticipate that three more will be lifted within the next month. We work very closely with our funders, Indigenous Services Canada, to be able to provide these services on a continual basis and are grateful for their support.”

— Melanie Debassige, MBA, ICD.D Executive Director, Ontario First Nations Technical Services Corporation. WC

Views like this can be preserved and protected with a little help from EAP. Oyster River, Comox Valley, B.C.

Source: Partnership for Water Sustainability in British Columbia

# The Ecological Accounting Process

A B.C. collaborative initiative BY KIM STEPHENS, TIM PRINGLE, AND RAY FUNG

**IF WE KNOW HOW TO DO A BETTER JOB** of protecting ecological features and stream systems in our communities and on our landscape, then why aren't we doing a better job? Why are streams still being degraded? Why do we still see practices that are embedded in land use policy and regulation that are decades old in some cases? How do we change that?

The degradation of stream channels and streamside riparian setback zones have driven the methodology and have established the metrics for Ecological Accounting Process (EAP). The methodology and metrics focus on the land underlying the natural asset. In the case of stream systems, this is the setback zone defined in B.C. provincial legislation.

EAP produces the financial value of this Natural Commons Asset (NCA) using B.C. Assessment data for parcels which abut the stream system. It is this asset which supports the combined range of uses (package of ecological services) desired and supported by the community—like drainage, habitat, recreation, and enjoyment of property. The NCA financial value alerts communities to the extent of alteration of the riparian features and

hydrology of the stream system. This is the Riparian Deficit.

Logically, a stream system is a land use comparable to constructed systems such as drainage, roads, park paths, and greenways, etc. The community expects commons assets to be maintained (prevent degradation) and managed (enhanced). This implied social contract requires planning and budgeting for maintenance and management. This would rightfully fit within a local government's asset management strategy that deals with the risk and consequences to the community of doing or not doing things.

EAP considers the entirety of the stream corridor system—a *natural commons*—and seeks to ensure that streams survive in an urban or urbanizing setting, without suffering from degradation of stream channels and streamside riparian setback zones. The worth of a creekshed is a package of ecological services made possible by the hydrology.

The term accounting is key to this process because it provides the opportunity to take stock and understand the worth of ecological services as the

community uses them. The perceived level of worth reflects community willingness to invest in stream preservation and/or restoration. Holding up this mirror reflects opportunities taken or missed and risks avoided or incurred. Simply put, it asks the question: How well are we doing?

At best, the ecological services provided by green infrastructure have been considered as an add-on. They are not intuitively understood by the public, elected representatives, and asset managers. Unless communities measure the effects of impacts, degradation of riparian assets and streamside setback zones will continue.

The good news is, EAP bridges a gap. It provides local government with a methodology and metrics for integrating natural assets, notably stream corridor systems, into municipal infrastructure. In this way, stream corridor systems can be considered on equal footing with constructed assets (municipal infrastructure) and be included in an annual budget as a line item within a financial plan.

A whole-system approach to the use



of green infrastructure would help communities move from stop-gap remediation of problems to long-term restoration of properly functioning stream systems.

## 5 ways EAP addresses stream system degradation

### 1. What is measured gets managed

What happens on the land matters: After all, what is measured gets managed. EAP provides local governments with a guiding philosophy, method, and metrics to determine the financial values for a stream corridor and adjoining setback zone. This is the Natural Commons Asset (NCA) value.

### 2. What is understood can be implemented

EAP finds the NCA financial value which quantifies the extent of land use intrusion into the setback zone. A higher dollar value means greater intrusion and reduced riparian area function. This is the environmental equivalent of the infrastructure liability (deficit) for constructed assets, such as underground utilities and buildings. The NCA value provides environmental planners with a starting point for a balanced conversation with engineers and accountants about the services that natural and constructed assets both provide.

**3. What has worth has value** EAP interweaves financial, social, and ecological perspectives within a single number to establish the financial case for a stream corridor system. EAP adds to the conceptual framework for a riparian area maintenance and management strategy with new insights about financial metrics. For example, a price per metre of channel length as a measure of the NCA value, and the community investment in the maintenance and management as a measure of the stream's worth.

**4. What is considered can be reconsidered** Riparian integrity is more than a regulatory setback width. EAP considers the 200-metre zone beyond the centre of the stream and asks the question: What is the quality of the riparian and woodland vegetation?

**5. What benefits one can benefit all** The



EAP supports the combined range of uses by the community—like drainage, habitat, recreation, and enjoyment of property.

EAP methodology focuses on the historical and current land use practices that have changed landscapes, modified hydrology, and have led to present-day community perceptions of the perceived worth of a stream and/or other water assets, and the ecological services those assets provide. The EAP methodology deals with the parcel because this is how communities regulate settlement and growth.

### Applied research: Test, refine, and mainstream

The Partnership for Water Sustainability in BC is collaborating with multiple local governments in five sub-regions within the Georgia Basin/Salish Sea bioregion, in the southwest corner of the province, to help them determine how to operationalize EAP within an Asset Management Budget.

The EAP program has tested and refined its metrics and methodology through nine projects in Metro Vancouver and on the east coast of Vancouver Island. These are building blocks in a three-stage program to mainstream EAP. In each case, an advisory group collaborates in the process.

The following two examples illustrate

EAP as it has been applied to different research questions.

### Comox

Brooklyn Creek is a regional environmental amenity and destination in the Town of Comox, a community of 15,000 on Vancouver Island. As the second EAP building block, the project led to four important perspectives or realizations early in the process of testing the EAP methodology. These proved to be foundational ideas going forward as the analytical methodology and description evolved through successive building blocks:

#### FINANCIAL VALUE OF A SETBACK ZONE

Using B.C. Assessment Data as a proxy, financial value can be assigned to riparian areas beyond the stream setback zone that are conserved to enhance the stream's functioning condition.

**STREAM WORTH** Investment in stream restoration establishes its worth (what the community has invested during, for example, the past decade).

**PACKAGE OF ECOLOGICAL SERVICES** The community expects the stream to provide a range of uses which contribute to core local government services.

**DESIRED ECOLOGICAL SERVICES** By

EAP seeks to ensure that streams survive in an urban or urbanizing setting, without suffering from degradation of stream channels and streamside riparian setback zones.



managing the stream's riparian zone, the community can maintain desired ecological services and reduce costly remediation of degraded streams.

The Ecological Accounting Process and findings led the Town to radically change its community plan process for a recently annexed green field area in the Brooklyn creekshed. The planning process began with identification and protection of key riparian assets. The recognition of the asset value of the stream system as a natural commons reversed the traditional approach which would have considered natural areas as a leftover in plans for community expansion.

### Langley

The Township of Langley is a community of 140,000 in the Fraser Valley within the Metro Vancouver region. The Township decided to apply EAP to determine a fair method to compensate rural parcel owners who would be willing to commit areas of their land to riparian and woodland maintenance and/or enhancement to support the condition of Bertrand Creek.

EAP is producing a financial strategy based on both urban and rural parcels which abut or are adjacent to the stream. It will reflect the connection of parcel owners to the stream system and its role in supporting intrinsic nature as well as community settlement expectations and realities.

The EAP spotlight is on what is equitable urban/rural mitigation investment. The Township will be able to use the strategy to persuade the community to invest more extensively in incentivizing ecological services.

### Looking beyond the stream channel

Whether constructed or natural, an asset is an asset. And in the built environment, each asset type requires an annual budget for sustainable service delivery. The accepted approach to asset management in British Columbia is non-prescriptive, flexible, scalable, and aligns with the spirit and intent of B.C.'s *Community Charter*, which is enabling legislation. In short, the focus is on outcomes.

All of us have an impact on the land and on the way things look. Getting it right, both in the stream channel and on the land draining to the stream, requires that all the players involved in the land use and development process embrace shared responsibility and align their efforts to achieve desired outcomes.

It is our hope that as EAP is applied and tweaked in these sub-regions by local government managers to influence the on-site actions of property owners, further channel and riparian degradation would be prevented and stream system integrity would be restored. **wc**

Kim Stephens, Tim Pringle, and Ray Fung are members of the leadership team for the Partnership for Water Sustainability in British Columbia. Kim Stephens, Executive Director, is a water resources engineer-planner. Tim Pringle, founding Director, leads the Ecological Accounting Process initiative. Ray Fung, Director, retired from local government as a director of engineering.

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Green roofs, like this one on the Vancouver Convention Centre, are helping to blur the line between traditional infrastructure and natural assets.

# Implementing Green infrastructure

Looking to nature for support BY JEN SMITH

## TAKE A SCROLL THROUGH THE NEWS

or social media and you're likely to see the term green infrastructure making an appearance somewhere on your feed. Sure, it sounds good and is probably something eco that you should definitely support. But what exactly is green infrastructure? And more importantly, how can Canada take advantage of this big idea?

In our most recent Blue Economy webinar, moderator Corinne Lynds asked a panel of industry experts just that.

## A broad definition

According to Roy Brooke, executive director of the Municipal Natural Assets Initiative, green infrastructure “includes three things: Natural assets, so think your forests, riparian areas, wetlands. And then enhanced natural assets. So, for example, bioswales, and rain gardens, and things of that sort. And then engineered natural assets. Think: permeable pavers, and green roofs, and the like. It's a broad category, a broad continuum.”

Thomas Mueller, president of the Canada Green Building Council, concurs with Brooke's assessment. He notes too that the launching of Canada's first National Infrastructure Assessment, “Building the Canada We Want in 2050,” which is meant to establish a long-term vision for the country and provide ways to fund infrastructure projects as they move toward a net-zero emissions future, means that the federal government is finally getting on board with green infrastructure. “For the first time, both buildings and natural systems are actually acknowledged as being part of ‘infrastructure,’” he says. And with that comes federal funding for sustainable, resilient infrastructure.

According to Brooke, “We're starting to see solid evidence that green infrastructure can have local life cycle costs, and that it can provide a range of co-benefits.”

Eric Meliton, manager of the Sustainability Office at Wilfrid Laurier University, agrees, adding, “There's a health and

wellness aspect that's incorporated into green infrastructure.” For him, green infrastructure implementation is more than just a means to curb climate change and encourage resiliency: it's something people *need*. During the pandemic, Meliton found that both students and academics at Wilfrid Laurier were drawn to nature. “Outdoor classrooms became kind of vogue again,” he says. “To be able to build that capacity here, we're excited for that. People are reengaging their interest in nature and we're able to provide those resources, and access, and experiential opportunities that green infrastructure and natural infrastructure can provide.”

Mueller mentions that while we need to incorporate more nature into our ever-densifying cities, it must be done in a thoughtful way. While adding a park here and there with a little lawn or a few trees is nice, it's “...an outdated concept now that needs to be really rethought,” he says.

And Lara Ellis, vice-president of Policy and Partnerships of ALUS Canada, couldn't agree more. Along with the

Resilient urban infrastructure programs need to include more natural assets like wetlands, forests, and riparian areas.



opportunities to “reap the mitigation and adaptation rewards for climate change” and encourage positive interactions between the community and nature, she also adds that green infrastructure creates an opportunity for restoration initiatives geared to preventing biodiversity loss.

### Resilience in infrastructure

We’ve already seen the devastating impacts of climate change. A growing population isn’t helping matters, especially one that demands more and more infrastructure to be put in place to meet its growing needs. But, we can’t just build our way out of the situation (even if Canada had the financial means to do so). In fact, we’re in what Brooke refers

to as an “infrastructure deficit,” and what we do have in place is old. “It has not been maintained properly. It needs renewal,” Brooke says. “If we want to be resilient in a changing climate, to the physical risks, we must start looking at nature differently because in urban and peri-urban areas, that is where nature’s benefits are most keenly felt because we’re closest to it,” says Brooke.

So, how do we create resiliency to climate change while meeting the changing needs of a growing population? Ellis believes that looking to natural infrastructure can hold the key. “We know that putting nature back on agricultural lands helps mitigate flood,” she says. “This past year, we’ve also seen that it’s very important in terms of drought, so

food security. We know that farms that have wetlands [and have] better soil fare much better during times of extreme weather. We know with climate change that water quality will continue to become more impaired at a faster rate. Natural infrastructure can help resolve that.”

### The tricky realities

While we know that implementing nature-based solutions is an essential consideration, Mueller notes that there is still reticence on many levels to dive in and embrace natural infrastructure, as it’s difficult for people to visualize it in the context of a citywide adoption plan: “On a practical level, the pushback you’re still getting against green roofs is actually quite amazing, right? And then you have this whole issue around land economics. And what do natural infrastructure systems will look like within a city context? And how would they have to be engineered?”

Meliton adds that many corporations have previously looked at green and natural infrastructures as a way to enhance certification. However, “the perspective is starting to change as people are becoming more aware of environmental social governance, CSR, and SDG-type of impacts, that now we’re starting to look at, ‘Well, does this impact our footprint? Are we causing problems downstream? Are we building resiliency for our company or our institution?’”

Mueller appreciates how offsets gained from carbon footprint reduction can be a compelling way for companies to boost their own portfolios with natural assets and systems, by noting that “We are already seeing that some real estate companies are buying forests and those types of assets for carbon offsets.” And, if these are properly handled could have “a positive impact on actually maintaining and bringing back some natural systems that have been degraded over the decades.”

One of the trickier parts of implementing green infrastructure isn’t just seeing the big picture, or even finding the funding: It’s that green infrastructure doesn’t mean maintenance-free. Even natural assets require care. Meliton points out that since much of the funding currently available doesn’t include future care of the project, “what ends up happening is you put in a

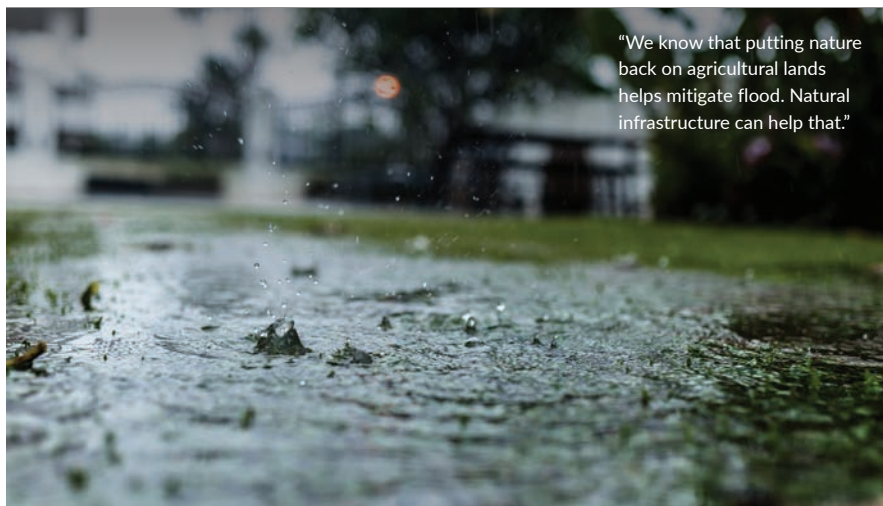


very expensive green roof, or a very expensive permeable pavement system, which was already a challenge to get approvals for, and now you don't have a way to maintain it...And to some extent, unfortunately, some of these projects get neglected."

Ellis expands on this, adding, "I think that, whereas the cost of natural infrastructure is very competitive with built infrastructure, there are ongoing costs. In terms of operating funds from municipalities or other investors, the ongoing maintenance is absolutely essential."

Brooke agrees, noting that "...you need to do a side-by-side full life-cycle comparison to get any sort of solid understanding. If you have an engineered asset, it will have an end of useful life. It's 50 years. It's 100 years, perhaps. But eventually, you have to dig it out and replace it. Whereas, if you maintain your natural assets appropriately, it may never have an end of useful life. In fact, it may become more valuable over time."

Brooke also points out that natural assets have an "inherent plasticity,"



"We know that putting nature back on agricultural lands helps mitigate flood. Natural infrastructure can help that."

and will continue to evolve (to a point) alongside a changing climate. Using the analogy of the rigidity of a pipe that doesn't grow or adapt because it's raining, he compares it to a natural asset that can provide "not only the core service, whether it's stormwater management, or flood mitigation, but a range of co-benefits. This could be anything from pollination, to health, social, recreational, heat island reduction.

If we're doing a comparison around capital, and operating, and maintenance expenditures, then we need to do a real comparison and look at all the variables, not just some of the variables."

To watch the full Blue Economy Webinar on green infrastructure and get in on the entire conversation, visit: [watercanada.net/blue-economy-webinar-series/](http://watercanada.net/blue-economy-webinar-series/)

Thank you to Ducks Unlimited Canada for sponsoring this important discussion. WC

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<p>Typically, we think about water in silos like drinking water, wastewater, and stormwater. During this webinar, we'll explore the benefits and drawbacks of integrating these silos under the One Water Approach. We'll also explore what changes might be needed if the Canadian water industry adopts this as an overarching concept going forward.</p>	

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Wastewater testing for SARS-Coronavirus is performed at over 200 sites in Canada.



# Murky Waters

What monitoring COVID through wastewater can (and can't) tell us BY CONNIE VITELLO

**AS PANDEMIC RESTRICTIONS HAVE EASED,** many Canadians have begun enjoying gathering again with family, friends, and colleagues in a more carefree manner. While smoother waters abound, the reality is that there are many moving parts working hard beneath the surface to keep us safe. Public health is carefully monitoring the Coronavirus disease of 2019 (COVID-19), an infectious disease caused by the SARS-Coronavirus, and its variants.

With limited polymerase chain reaction (PCR) testing available and recognized limitations of rapid antigen tests (RATs), wastewater surveillance has become Canada's best tool to track emerging cases.

Currently, wastewater testing for SARS-Coronavirus is performed at over 200 sites in Canada, including all provinces and two territories. Internationally, wastewater testing for this virus has rapidly expanded with over 2,200 testing sites in 55 countries.

However, experts warn there are

limitations and challenges involved in attaining accurate results.

## Wastewater soup

On March 11, 2020, the World Health Organization (WHO) declared the COVID pandemic. While much has been learned about this powerful and contagious coronavirus, it continues to evolve and elude scientists and public health officials. Nearly 500 million people have been infected in approximately 200 countries. More than six million people around the globe have perished. In Canada, as of March 25, 2022, there have been almost 3.5 million cases and more than 37,000 deaths related to COVID.

The original virus has rapidly evolved into a string of variants. Fortunately, these can be detected in the stool of infected people over a significant portion of their illness, providing an opportunity to test and monitor wastewater for the presence of COVID in communities and institutional settings without the need for individual testing.

Wastewater surveillance can be used as an early indicator for the presence of infections not yet detected by traditional clinical surveillance, offering a picture of public health in the absence of symptoms and individual testing.

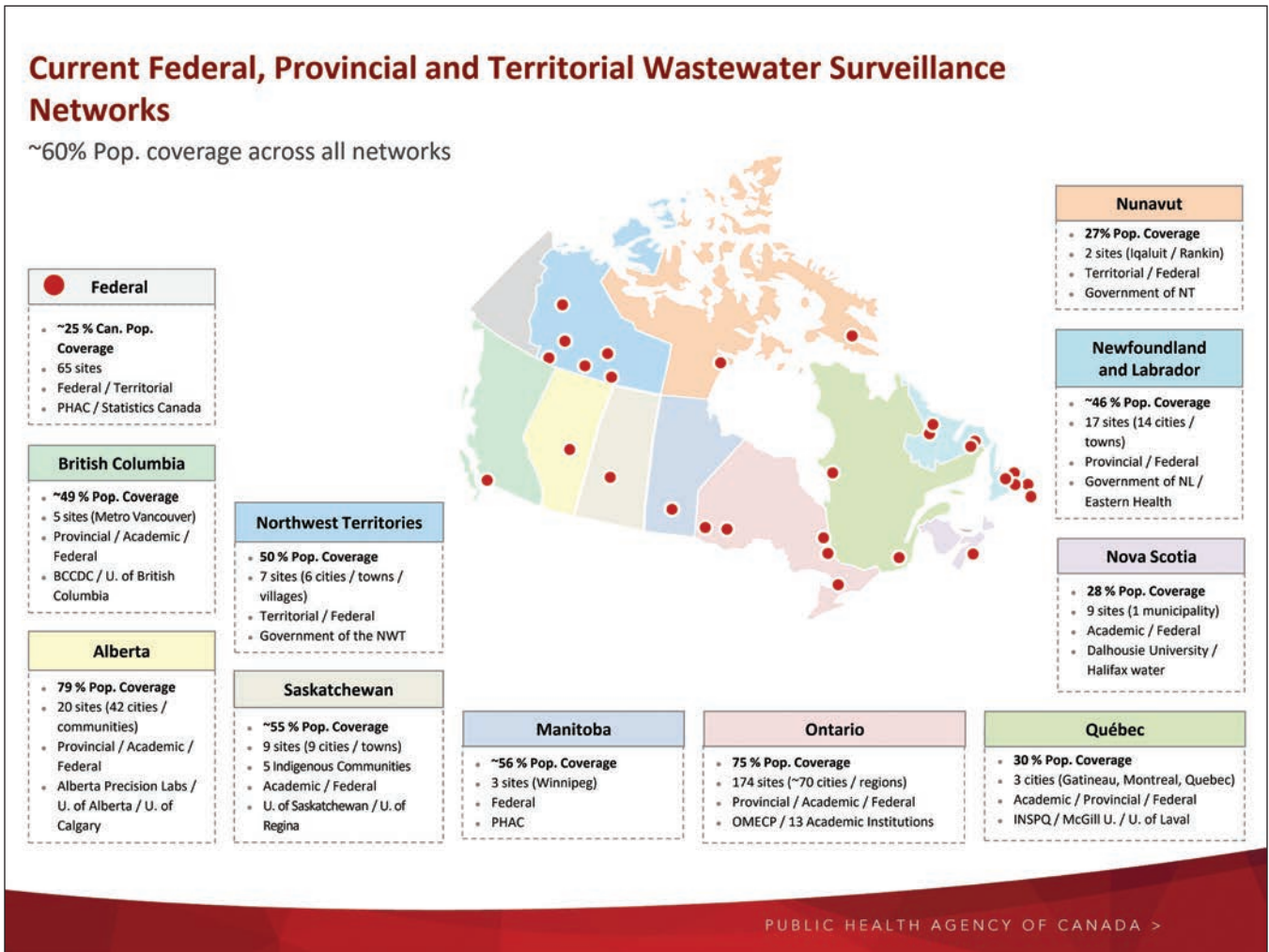
So how exactly is this wastewater surveillance carried out?

The Public Health Agency of Canada (PHAC) is working in collaboration with other federal departments, provincial, territorial and municipal governments and academia across Canada to establish a pan-Canadian wastewater surveillance network capable of monitoring the spread of COVID in Canada.

As COVID can be characterized by symptomatic and asymptomatic infection, it is important to identify the presence of undiagnosed cases to minimize the likelihood of outbreaks. Even a few days of early warning can be critical to the success of public health interventions and can be an imperative source of information for public health action.

Dr. Kimberley Gilbride is a professor





A map indicating the location of federal and provincial wastewater surveillance networks as of June 2021.

and acting associate dean for the faculty of science at Toronto Metropolitan University in Toronto, Ontario. Her lab is working to help to track the prevalence of COVID in local communities. Samples are tested from sites all over the city, including large treatment plants and community and congregate sites, such as university residences, shelters, and long-term care homes.

Does this university’s procedure differ from other academic or public testing facilities?

According to Gilbride, most university labs are processing solids from raw wastewater, although a few are processing primary sludge, and a few are processing supernatant (the liquid lying above a solid residue after crystallization or precipitation). Her team has not seen a significant difference in detection between the sources or procedures as

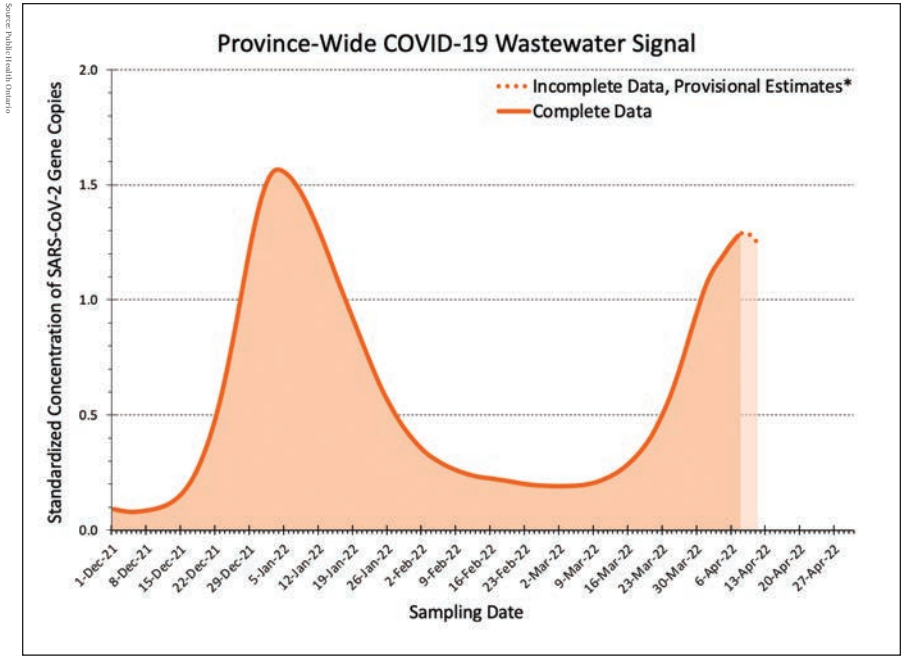
other labs doing similar work, as they have processed joint samples for comparison.

“In my lab, we process from raw wastewater and simply centrifuge the samples to collect the pellet and then extract for RNA [ribonucleic acid]. Although there are minor differences in the exact protocol between labs, the overall process is very similar,” explains Gilbride. “Different variants just require different primers for the RT-qPCR [reverse transcription quantitative real-time PCR] step. I think that every RT-qPCR reaction gives us accurate results, and all those using this analytical method get very similar results. However, the variation we see in detection — between samples, between labs, and between sites — is mostly due to the variation in the sample we are testing.”

What are the key challenges involved in providing accurate surveillance results?

The best way to explain this, according to Gilbride, is to imagine that wastewater is chicken vegetable soup. When you take a spoonful, you cannot guarantee that you pick up exactly the same number of carrots pieces each time. Even if you stirred the soup before portioning it into bowls, each bowl would not have exactly the same numbers of carrots or chicken in their bowl; hence, variation. The same thing happens with wastewater samples; some samples are more homogenous than others. (For example, poop comes in different consistencies and therefore single samples may vary.)

Gilbride adds that they normalize their COVID RNA copies with pepper mild mottle virus (PMMoV) since the latter is common in diets (but again may vary between different locations) and its presence in waste represents the amount of poop when analyzing for COVID.



The rate of COVID virus in Ontario wastewater greatly dropped over the winter months but started to rise again this spring.

“So, in other words, if we count chicken pieces in the soup, we can predict how much soup we are analyzing assuming the soup is homogeneous. Then, when we look for COVID, we determine how many carrots we have relative to chicken to see if the signal is going up, going down or steady. The challenge is always with the sample we get in the first place.”

How homogeneous is it? “It’s very hard to standardize unless we could get everyone to give us standardized poop samples — impossible! Having said all of this, the normalization with PMMoV has worked extremely well.”

Similarly, Metro Vancouver is working with the British Columbia Centre for Disease Control (BCCDC) and the University of British Columbia to track the presence of the COVID virus in the region’s wastewater.

Sableen Minhas, BCCDC’s communications specialist, says that their Public Health Lab (PHL) already had an existing collaboration, methods, and equipment for testing enteric viruses in wastewater prior to the pandemic, which meant the lab was able to quickly switch gears to test for COVID.

“The process to detect SARS-CoV-2 in wastewater usually involves collection of a sample from a wastewater treatment plant, preparation steps to concentrate and

extract viral RNA and analysis for genetic markers of SARS-CoV-2 using quantitative, reverse transcription polymerase chain reaction (RT-qPCR),” says Minhas.

Wastewater is collected three times a week and the results are posted every Friday. Analyzing untreated wastewater samples is complex and takes longer than a typical lab sample. To get accurate results, multiple factors and samples need to be taken into account; the complete process includes collection, transportation, processing, testing, and analysis. An interactive map provides current data for those who want a snapshot of COVID virus trends for various areas in B.C.

### Wastewater testing woes

As the science continues to evolve and studies continue to be critical of evolving scientific methods, some definitive pros and cons to wastewater testing have been revealed.

One comprehensive study conducted by Ontario’s Science Advisory Table, a group of scientific experts and health system leaders who evaluate and report on emerging evidence relevant to the COVID pandemic, has identified three challenges that warrant further consideration to ensure better wastewater testing reliability:

**ANALYTIC METHODS** Approaches for sampling and measuring viral RNA vary considerably across jurisdictions, as do the populations surveyed and the sewer networks. There is a need for improved quality assurance between analytical methods, as well as consistency in data interpretation within local context.

**SURVEILLANCE PROGRAMS** Most wastewater testing programs worldwide are still in the developmental stages, and while capacity is expanding, there is a need to transition to a sustainable system.

**COLLABORATION ELEMENTS** Public health, testing laboratories, and wastewater utilities need to collaborate to ensure testing provides actionable public health intelligence which is interpreted and communicated and actioned effectively.

The study, which was published in August 2021, also notes that the PHAC, the WHO, the Centers for Disease Control and Prevention (CDC) and others have also identified analytic methods, reporting, and interpretation of tests and program sustainability as areas that require additional development.

The consensus is that wastewater testing as a surveillance tool for COVID is relatively new and requires ongoing development, standardization, capacity building, and sustainable infrastructure.

### Cultivating quality assurance

There are organizations working to improve the development of quality assurance and early warning wastewater screening of COVID. The Canadian Water Network’s COVID-19 Wastewater Coalition, which brings together municipal utilities, researchers, public health agencies, and governments, is one such organization.

The COVID-19 Wastewater Coalition is sharing critical knowledge — and providing critical context — to accelerate progress and help ensure that surveillance results can be both sufficient scientifically rigorous and useful to public health authorities.

When Bernadette Conant, CEO of the Canadian Water Network, became aware of the emerging science around COVID she mobilized and led the launch of the coalition in March 2020. The coalition recognizes the need to marshal



resources and help frame the discussion in Canada.

Together with a team of leading water experts, the coalition is focussed on answering a few key questions. First, does surveillance testing work? Yes, the caveat is always that there has to be a careful process. Secondly, can we trust the data? Mostly the answer is yes. The sticking point is that this is a new science, and has not yet passed to the accreditation stage. Finally, are the data useful or being used for public health decision making? That's where it gets a little murky.

“Omicron really changed the conversation around, and greatly upped the interest in, wastewater surveillance,” points out Conant. “We were having a new wave and it quickly challenged the ability to keep up with PCR testing.”

Wastewater testing became more important for the ability of understanding how widespread omicron was in the community. Suddenly, says Conant, there was more confidence in the wastewater testing signals.

The coalition is a community of aligned

experts who are helping to provide evidence informed decision making. Conant emphasizes the importance of providing context to the research and making accurate real-world decisions.

“One of the things that is in our new strategic plan and one of our strengths is being ‘context experts’ as well as ‘content

As we go to press, wastewater dashboards are suggesting a rise. The surge is mainly taking place in Quebec, Ontario, Alberta, Saskatchewan, and parts of British Columbia. There's speculation over what that will mean — a sixth wave of the pandemic or a blip that is the beginning of the endemic? Public

**“Omicron really changed the conversation around, and greatly upped the interest in, wastewater surveillance.”**

experts.’ The coalition is helping to provide this service by getting the right people in the room at the right time and helping everyone feel involved,” explains Conant, who is passionate about providing clarity and guidance in this evolving environment.

Due to changes in COVID-19 testing policies in many jurisdictions starting in late December 2021, the PAHC warned that case counts would underestimate the total burden of disease.

health is keeping an eye on infections, health impacts, and hospitalization rates.

Something is coming and we don't know exactly what. In the meantime, let's responsibly enjoy easing restrictions as wastewater surveillance continues to improve and provide a (relatively accurate) heads-up. WC

Connie Vitello is the editor of EnvironmentJournal.ca

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# Breaking Ground

## Canadian environmental remediation experts lead efforts to address PFAS

BY RYAN MOORE

**GROUNDWATER IS A CRITICAL RESOURCE** that is “overlooked and undervalued,” its degradation incurring “enormous costs for society,” according to the The Expert Panel on Groundwater. Although 30 per cent of the population relies on groundwater for potable use, increasing to 80 per cent in rural areas, due to its unseen nature, it is easily ignored.

Over the past several decades, Canada’s steadily increasing population and industrialization have led to a steady decline in groundwater quality, with estimates of more than 30,000 contaminated groundwater sites contributing to the significant problem. Contaminants such as fuel hydrocarbons (e.g., gasoline, diesel, jet fuel) and chlorinated solvents from spills at industrial, military, and dry cleaner sites are some of the most frequent contaminant types requiring cleanup. Although this is a growing problem, most contaminated sites, and efforts to resolve them go unnoticed by the general population.

However, with daily news sources sharing stories on PFAS (per- and polyfluoroalkyl substances) and their effects on the environment, the public’s awareness is rising.

In the past few years, PFAS, have emerged as an alarming environmental and human health issue. A 2019 Health Canada report found the chemicals in the blood of virtually everyone tested, even surpassing the detection frequency in the U.S. population. Exposures to PFAS have been associated with many health problems, including a range of cancers, while toxicologists have only begun to scratch the surface on studying the health effects of the compounds, individually and cumulatively.

‘Forever chemicals’ number in the thousands of individual compounds and are widespread globally, with impacts being felt as far away as the Northern Territories and Greenland. PFAS, perhaps more than any other contaminant class, are prompting many to take notice of groundwater. The societal cost to

address PFAS will be steep—one estimate suggests 42,000 sites and \$80 billion for cleanup worldwide.

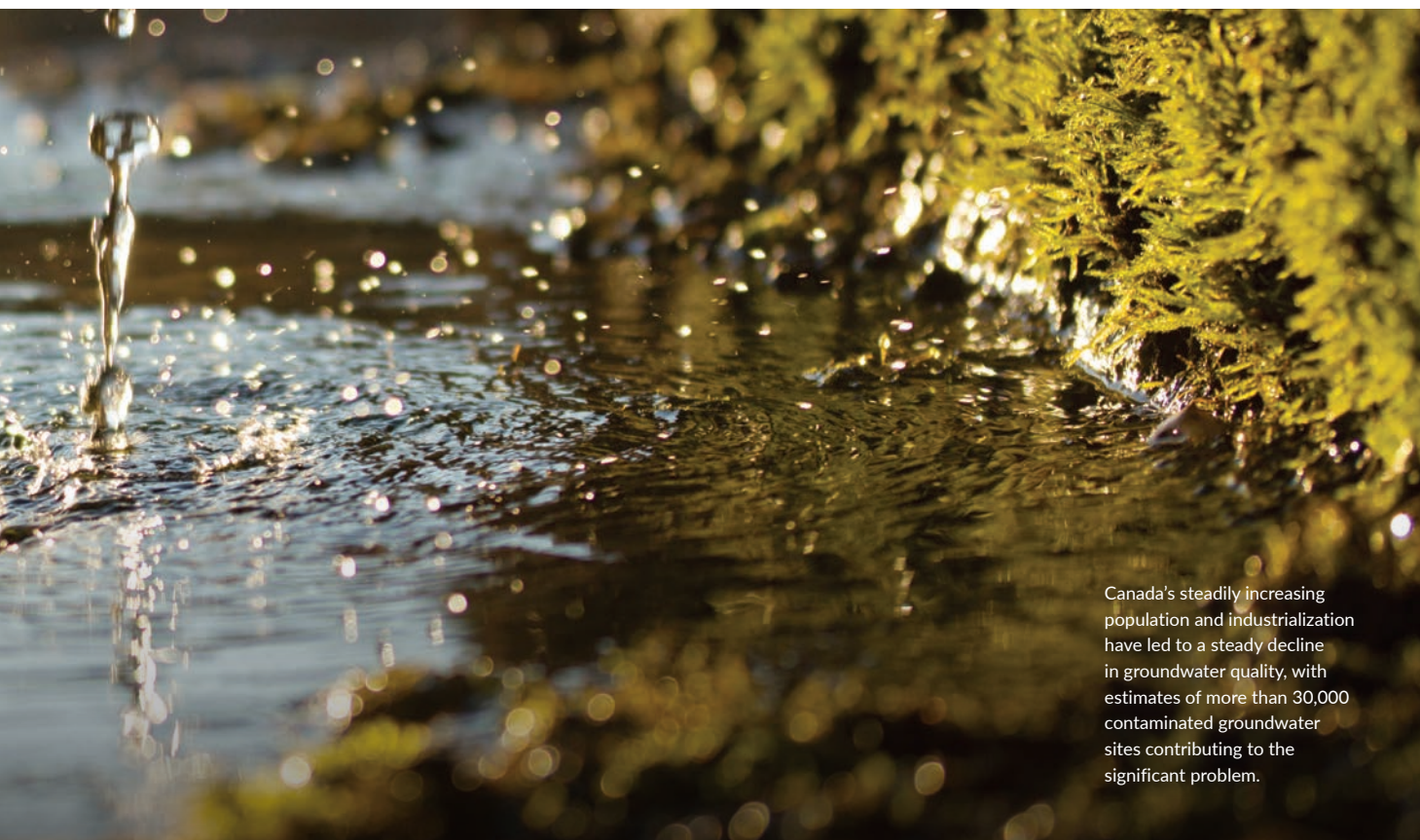
### Leading the way

One Canadian groundwater remediation firm is leading the way to address the PFAS problem.

Rick McGregor, president and CEO of Ontario-based InSitu Remediation Services, Ltd. (IRSL), was the first to demonstrate the successful *in situ* (i.e., in-place) treatment of PFAS in groundwater. A University of Waterloo-educated hydrogeologist, his approach involved sequestering the contaminants in place using a patented form of colloidal activated carbon (CAC).

CAC comprises of micron-sized particles treated with an anti-clumping agent that allows the material to flow through the small openings between individual soil grains. With an ink-like appearance, the amendment is injected into the subsurface using wells or specialized screens drilled and installed





Canada's steadily increasing population and industrialization have led to a steady decline in groundwater quality, with estimates of more than 30,000 contaminated groundwater sites contributing to the significant problem.

into the contaminated zone. The material coats aquifer solids with a film of activated carbon upon injection. Organic contaminants like PFAS adhere to CAC-coated solids and are filtered out of groundwater, eliminating any potential exposure risk.

### Treatment in situ

In 2016, IRSL successfully implemented the first *in situ* PFAS treatment, completing a project in Central Canada where fire-training exercises using PFAS-containing firefighting foams were conducted during the 1970s and 1980s. The PFAS released from the foam migrated through the subsurface and impacted the shallow groundwater.

Following treatment, the contaminants were sequestered onto the carbon and removed from groundwater by the first post-injection sampling event three months later, achieving reductions to the low parts-per-trillion laboratory detection limits. These reductions have been maintained for over five years thus far, making it the longest-running sustained *in situ* PFAS treatment worldwide.

While the first PFAS site's treatment has

proven to be effective for half a decade, there is great interest in solutions that remove PFAS from groundwater and eliminate exposure risk for much longer. Extended *in situ* PFAS treatments are especially desirable since alternative approaches are energy-intensive, thus not sustainable, and economically impractical to address most impacted sites.

To answer the longevity question, McGregor teamed with Dr. Grant Carey, president of Porewater Solutions and an expert in mathematical modeling, site characterization, and environmental forensics. With a Ph.D. in civil engineering from the University of Guelph, he has developed modeling and visualization software many in the industry rely on for groundwater assessment and remediation.

For the Central Canada PFAS project, Carey was asked to develop a model to estimate treatment longevity. The modeling results, published in the peer-reviewed industry journal *Remediation* and coauthored by McGregor, indicate the CAC treatment will contain PFAS within the treatment zone and prevent further PFAS migration in groundwater for more than 60 years.

Due to its passive approach, which does not require equipment installation or long-term maintenance, IRSL implemented the *in situ* treatment at a small fraction of the cost of operating a groundwater extraction and sorption treatment system, the other remedial alternative considered.

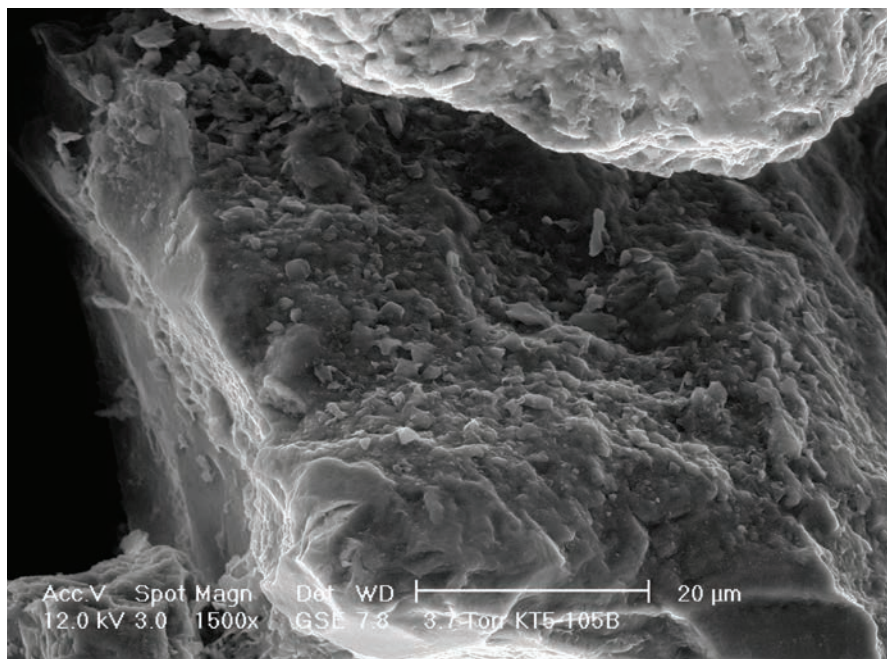
### CAC-PFAS Success

Since their first PFAS treatment, IRSL has completed additional PFAS remediation projects, both in Canada and internationally. All are proving successful. A recent PFAS Remediation Experts Symposium, memorialized the results at three of the IRSL *in situ* PFAS treatment sites, showing 18 months or greater total PFAS elimination thus far as performance monitoring continues.

CAC's high surface area to mass ratio results in rapid removal of PFAS and other organic contaminants from groundwater (i.e., days to weeks) following application. The approach is used to stop migrating PFAS plumes and eliminate exposure risk to potential receptors downstream, like potable wells or surface water bodies. As Carey's modeling estimates at the Central



SOURCE: REGENESIS



Scanning electron microscope image shows CAC coating sand grains.

Canada site suggest, a standard *in situ* CAC treatment is typically designed to sorb PFAS and prevent their migrating in groundwater for decades.

### Wide range applications

Beyond PFAS, IRSL continues its full project load in remediating other contaminants using the *in situ* approach, using the CAC material to remediate numerous chlorinated solvent sites across Canada. Chlorinated solvent treatments are usually combined with other chemical substrates that cause contaminants like

tetrachloroethene and trichloroethene to be transformed into harmless byproducts via a biogeochemical reduction process. These added substrates include materials that feed hydrogen into an aquifer at a controlled rate, facilitating microbial degradation of the solvents, and colloidal zero-valent iron, which creates conditions that significantly improve the timeframes to treat these contaminants fully.

Additionally, in recent years, IRSL has applied an activated carbon-sorption technology containing additives to facilitate bioremediation of fuel contaminants at numerous gas bars

and petroleum release sites throughout Canada.

Working in the field to address PFAS and other contaminants directly, McGregor knows that correctly targeting the treatment and effectively distributing the amendment(s) are needed for remedial success. He shares that “One of the big advantages of *in situ* is the ability to target the actual area of contamination. So, you’re being a lot more effective with your remediation reagent, as well as with how you’re putting it in the ground. In the case of PlumeStop® (CAC), it’s one of the easiest reagents to inject physically. We can actually get it into the ground and get very good distribution.”

McGregor and Carey are principal figures in restoring groundwater in Canada and beyond. Their combined efforts have led to the successful remediation of many contaminated sites throughout the world. Together, they have moved the industry forward in its nascent efforts to assess and combat the PFAS problem using sustainable approaches, employing technological innovation, and supplying the industry with expert modeling and consulting support. Groundwater, an often overlooked but precious resource, has not escaped their attention. [wc](#)



Ryan Moore, CHMM, is PFAS Program Manager at REGENESIS®

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# Data Meets Action

## The Riparian Web Portal BY ROSEMARIE FERJUC, HEATHER J. MARSHALL, AND MARY ELLEN SHAIN

**IN 2002, ALBERTA FARMER DON RUZICKA** was facing the worst drought in recent history. Fortunately, five years earlier, Ruzicka had worked with Ducks Unlimited Canada to restore a wetland on his property which was now functioning as a natural reservoir to retain water. As the drought worsened, his neighbours whose man-made dugouts had dried-up, asked if they could use water from Ruzicka's still-saturated wetland. Ruzicka immediately agreed. He recalls, "Within one week, Alberta Agriculture had a huge pumping system moving water from one place to another and we filled two dugouts." Ruzicka also notes: "We still had water; the neighbours had water—it was a win-win situation for everybody."

The drought of 2001 was the worst experienced by the prairies in the past hundred years, but according to predictive models it will not be the last. Wetlands are among several landscape features known as natural infrastructure (or natural assets), that play an important role in watershed and community

resilience against drought. Along with riparian areas, forests, and aquifers, wetlands have the capacity to store water on the landscape and release that water slowly, attenuating the effects of drought and downstream flooding.

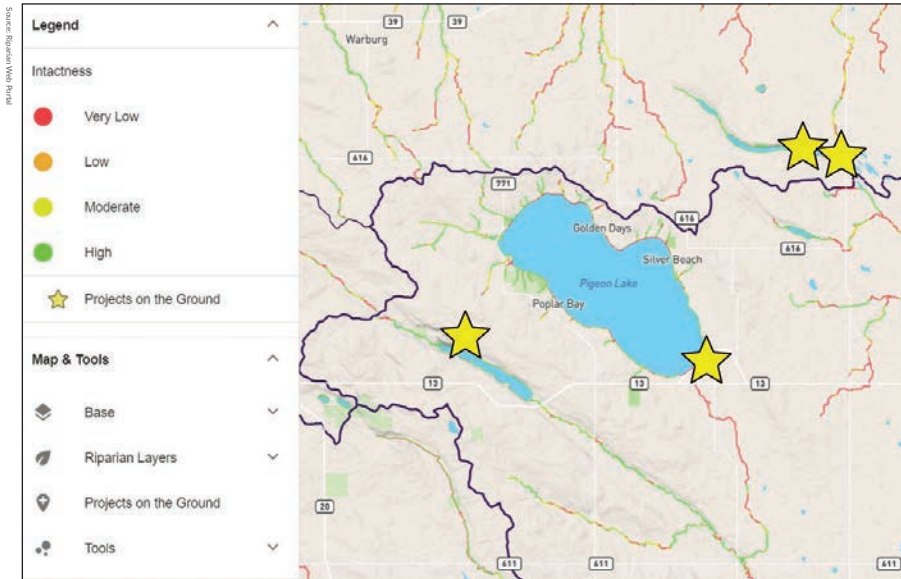
Maintaining healthy, resilient, natural infrastructure can provide additional benefits, such as source water protection and mitigating the costs associated with expensive natural disasters. Encouraging more conservation and restoration projects, such as Don Ruzicka's, is the goal of a new project initiated by a group of provincial Watershed Councils in Alberta.

### Unifying tech

"Some of our provincial Watershed Councils co-created a new website where we can showcase conservation and restoration projects; and because the projects are showcased beside environmental datasets, we can draw the link between data and action," says Mary Ellen Shain, senior project

coordinator at the North Saskatchewan Watershed Alliance. "Regardless of which stewardship organization leads the project, this website can bring together their projects to showcase the efforts of the collective stewardship community."

In 2016, municipal leaders who work with the North Saskatchewan Watershed Alliance agreed that riparian areas play a key role in watershed health. Described as the "interface between land and water" by water professionals, riparian areas form a vital buffer of protection between actions on the landscape and downstream impacts to our water bodies. Yet, little was known about the local conditions of these important habitats. Though several municipalities were promoting and supporting riparian restoration projects in their jurisdictions, municipal councillors didn't have a clear sense of how each of their projects fit into the big picture. This challenge inspired the North Saskatchewan Watershed Alliance to provide municipalities with big picture data of riparian conditions.



The Riparian Web Portal in action.

“Riparian areas are a key interest of our watershed stakeholders, so in 2016 we initiated the Riparian Health Action Plan. It began as a data-creation pilot project to help us gain a bird’s-eye view of riparian areas” says Shain. And as the project moved along, the NSWA councillors “wanted to ensure that the data was coming to them in a form that they could actually use.” Access to data was an issue for less technologically-equipped municipalities, so a user-friendly tool was needed: Thus, the genesis of the Riparian Web Portal.

**A practical portal**

The Riparian Web Portal is a space to showcase the data and connect to the people who can improve riparian health through on-ground projects. “We workshopped the idea with stakeholders to really clarify its use,” says Shain. Municipal councillors wanted an education-outreach component to the Portal to motivate residents towards action; ENGOs wanted to connect their programs to landowners excited to host on-the-ground projects. “And what better way to do that than on a map?” says Shain. Having map data side-by-side with local projects helps visitors to the Portal connect the dots between issues and how they are being addressed at a grassroots level.

Watersheds are at the heart of some of our most pressing development and

economic challenges. As part of a well-functioning watershed, riparian areas—the shorelines at the edges of streams, rivers, lakes, and wetlands filled with plants—are essential to safeguarding communities in the face of flood and drought risks. These transition areas between aquatic and terrestrial land help filter and store water, prevent erosion, and support biodiversity. Understanding the connections between these natural areas and how human-driven interactions at the landscape level upstream result in downstream impacts, encourages partners to work together in support of key water outcomes that we care about most.

**Collaborative pursuits**

Watershed management in Alberta is a partnership-based, voluntary framework. Watershed Planning and Advisory Councils (also called WPACS) are an important part of the framework; for each of the eleven major river basins each Watershed Council brings together stakeholders from that area who are interested in its management. Each Watershed Council is autonomous and has fostered a unique approach to identifying watershed issues, needs, and opportunities; allowing them to explore innovative grassroots approaches to solving those issues. Watershed Councils also work collaboratively at both the provincial and regional scale

to advance water and land management. The Riparian Web Portal was one such opportunity. Beginning as a concept with one council, each new additional partnership brought a suite of strengths that helped the Portal grow.

**Building blocks**

Each participating Watershed Council collected riparian data using identical satellite methodology to map riparian intactness and condition. Currently, the Portal hosts over 40,000 kilometres of riparian intactness data, spanning six watersheds in Alberta: North Saskatchewan River, Battle River, Red Deer River, Athabasca, Beaver, and Lesser Slave Lake. The datasets do not cover the province wall-to-wall, but reflect areas where riparian health is of priority concern.

The Riparian Web Portal provides visitors with access to a unique digital library of riparian resources and educational materials. Visitors can also view examples of on-the-ground restoration projects by landowners and conservation groups and are able to upload their own projects to the Portal. Spatial data products and summary reports can help support riparian conservation and restoration, land-use planning, and extension activities by Alberta municipalities, landowners, and stewardship groups.

**Holistic approach**

When senior biologist and director of Fiera Biological Consulting (FBC), Dr. Shari Clare, was brought on to the project, she suggested modernizing the pre-existing methods. The new method, which uses satellite imagery, was validated against existing aerial videography and on-the-ground methods.

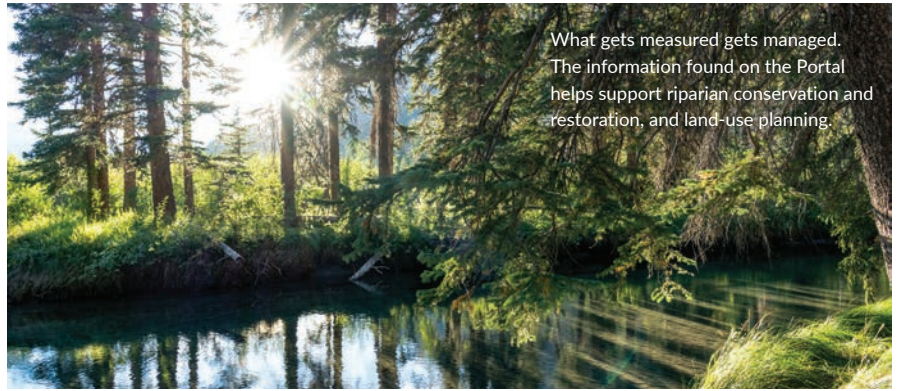
Clare calls this tool “strategic from a watershed planning and management perspective,” particularly for “larger spatial extents.” She adds, “This allows for targeting how municipal dollars are spent and prioritizing specific areas for on-the-ground action.” Clare also says that the Web Portal “mobilizes people to start having conversations about riparian areas and riparian conditions. And even if you look at the data and disagree with it, then at least you’re coming to the table to have a conversation about risk management.”



Different methods to evaluate riparian conditions have strengths and weaknesses, but when combined, can create a holistic picture of riparian conditions. While boots-on-the-ground assessments give a high-detail inventory of the plants and soil at a specific site, satellite assessments allow for the ability to scan more areas at once, which help identify priority areas for action or subsequent on-the-ground assessments.

Following the data collection, BlueGeo geoscientist and developer Devin Cairn was hired to create the Portal to house the data and mapping components. He points to the Portal as bringing “complex water issues and the idea of social networking closer together.” Cairn goes on to note that, “the general public is going to need this information in the future with issues like climate change, more pressure on watersheds, and land use change.” He adds that projects like the Portal will not only change how data is shared and built but will mean “public-driven content in the future when it comes to water.”

Although still an emerging resource,



What gets measured gets managed. The information found on the Portal helps support riparian conservation and restoration, and land-use planning.

the Riparian Web Portal has been piloted to 33 municipalities and Watershed Councils have trained over 250 portal ambassadors, planning staff, and agricultural producers across the province, with positive feedback on the functionality for users. Ultimately, Alberta Watershed Councils hope that anyone interested in water and land management will consider using this new resource to support an ongoing dialogue about riparian management. For more information on this project, visit [www.riparian.info](http://www.riparian.info). WC



Rosemarie Ferjuc is the Engagement and Communications Manager for the Red Deer River Watershed Alliance



Heather J. Marshall is a freelance writer and graphic designer.



Mary Ellen Shain is the Senior Watershed Planning and Project Coordinator at the North Saskatchewan Watershed Alliance

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# Improved Monitoring of Anaerobic Digestion

## Optimizing co-digestion for municipalities and agricultural feed stocks

PATRICK KIELY, AND JULIANA MEJIA-FRANCO, CHRIS BUSH, AND JAMES IRWIN

**THERE IS SIGNIFICANT MOMENTUM** building with the renewable biogas industry in North America as it offers an opportunity to help reduce GHG emissions by diverting organic waste from landfills to anaerobic digestion treatment facilities. Since methane gas is approximately 25 times more powerful when compared to carbon dioxide in its warming effect on the atmosphere over a 100-year horizon, finding ways to limit methane escaping from landfill has significant environmental benefit.

The push for renewable biogas has been in part catalyzed by the Californian Bill SB 1383, an aggressive environmental policy that establishes specific targets and timelines to divert organic waste (particularly food waste) away from landfills, thus reducing emissions of methane. The boost in biogas deployments across North America is taking place in two distinct areas: Municipalities who are looking to boost biogas production at

wastewater treatment facilities that have existing (and under-utilized) anaerobic digestion assets, and the agriculture and food processing industries who are looking to manufacture on-site digestion systems that can process the waste streams being generated.

One key technical gap that has existed for operators of anaerobic digestion (AD) systems is that they have routinely been operated as “black boxes.” Getting information from these biological treatment systems that could be used to optimize performance has been remarkably challenging resulting in digestors being built with excess capacity or being under-loaded and not optimized for maximum biogas production rates.

Two Canadian companies are working together to solve this data quality issue and develop a new process for understanding the health of AD systems. Catalyst Agri-Innovations Society wants to create a pathway for farmers to

access a suite of technologies that can allow them to successfully install and operate on-site AD systems, and with the help of SENTRY’s bio-electrode monitoring sensor platform as the key tool in understanding the impact of various agricultural feedstocks on the performance of AD systems, they are well on their way of getting there.

### AD systems in action

On-site AD systems for processing agricultural waste streams are typically run reactively; this means that operators wait for negative data from bench-scale manual tests in order to make decisions. But by using digital signals that provide real-time alarms direct from the anaerobic treatment reactors, operators can be proactive and make decisions that maximize organic loading and biogas production.

This is where the SENTRY monitoring system comes in.



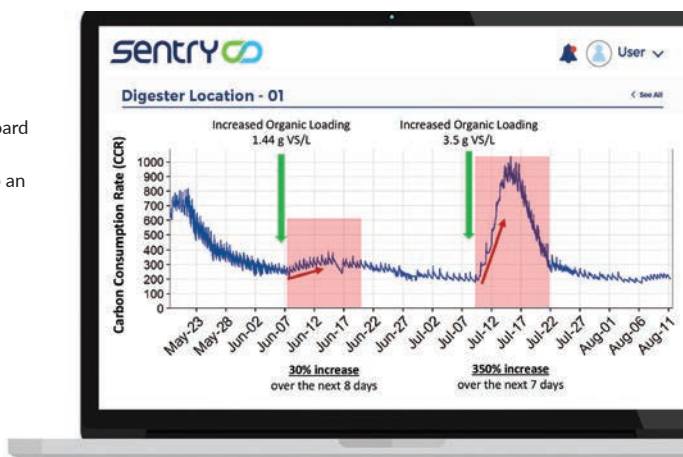


Catalyst Agri Innovations Society, Chris Bush and James Irwin shown in their Anaerobic Digestion test facility at the Abbotsford EcoDairy.



EcoDairy facility in Abbotsford, British Columbia

SENTRY online dashboard showing the impact of different feedstocks to an anaerobic digester.



Case in point: SENTRY’s monitoring system was installed at the Bakerview EcoDairy, Abbotsford, British Columbia, whose digesters are fed every two-to-four weeks with a combination of chicken and hog manures.

Consisting of a control and data management panel and two sensors, the system is able to send key information directly from the sensor to an online dashboard where operators get a real-time view of the health of the biomass in the reactor. One of the key benefits of SENTRY is that operators do not have to do regular, manual sampling of the wastewater in the digester, but can instead take action when an alarm notifies them of any biomass issues or events.

Because the SENTRY system provides a direct measurement of microbial activity (carbon consumption rate) of the microbial community in the anaerobic digester, it provides novel insights to assess the health, stability, and effectiveness of the biological process through the microbial populations responsible for the treatment and their

responses to monthly feedings. And its biofilm-based system means that the signal is remarkably stable in wastewater environments and requires limited maintenance or cleaning.

At the most basic level the SENTRY signal is used to visualize the batch feeding of reactors in order to understand how best to optimize feeding or organic loading to the digesters. This allows the operator to see very clearly the impact of different feed-stocks on the performance of the anaerobic digesters. The SENTRY signal can also show the impact of various process control changes, for example changes in internal recirculation rate or temperature on biological activity and treatment performance.

Eventually, the goal is to combine SENTRY signals with artificial intelligence and learning algorithms to develop optimized organic-loading strategies and eliminate manual wastewater testing to maximize biogas production rates.

The SENTRY team are currently providing real-time process monitoring to twenty anaerobic digesters with

systems operational in Canada, United States, Netherlands, India, and Brazil. The immediate value to these clients is that they can use the sensor signals to detect problem feedstocks and reduce the risk of biological upset and lower biogas production. The longer-term goal is that these sensor signals can be used to maximize the efficiency of anaerobic digestion systems by optimizing feeding to the digesters with target estimates to increase biogas production rates by 20 per cent. **wc**



Patrick Kiely is CEO at SENTRY



Juliana Mejia-Franco is Client Manager at SENTRY

Christopher Bush is Director at Point 3 Biotech Ag-Tech Consortium and President at Catalyst Agri-Innovations Society  
James Irwin is CEO Point 3 Biotech Corp



Nature-based solutions like natural infrastructure can help absorb water flow and reduce flooding.

## Nature Force: a new climate resilience initiative using natural infrastructure

**IN JULY 1996**, two weeks of persistent rain culminated in a downpour that overwhelmed Saguenay, Quebec's rivers and reservoirs, resulting in the first natural disaster in Canada's history to have damages exceeding \$1 billion. Unfortunately, floods of this magnitude have become more common and continue to result in devastating losses of life and property.

According to an Insurance Industry of Canada (IIC) 2020 report, the cost of severe weather-related insurance claims is expected to more than double over the course of this decade, hitting \$5 billion annually. While the direct financial burden of this will be felt by insurance providers and governments in the form of financial aid, Canadians are likely to be impacted through increased premiums and taxation.

Natural disaster resilience needs to be a focus for all communities across Canada. This is why 15 proactive P&C insurance companies have partnered with Ducks Unlimited Canada, a leading conservation non-profit, in a landmark initiative called Nature Force, to mitigate flood risks to urban communities. Nature Force will deliver natural infrastructure projects in B.C.'s Fraser River Delta, as well as areas in southern Ontario and Quebec.

Nature-based solutions like natural infrastructure (often referred to as green infrastructure) involve actively restoring and managing natural areas for positive outcomes, including climate resilience, biodiversity, and water quality.

"Healthy and interconnected wetland systems are phenomenally good at absorbing significant water flows and reducing flooding, while providing critical habitat to hundreds of species of wildlife, sequestering carbon, and filtering contaminants from our watersheds," says Mark Gloutney, national director of science for Ducks Unlimited Canada.

Natural infrastructure also makes economic sense. The International Institute for Sustainable Development (IISD) recognizes the important role that nature-based infrastructure (NBI) can play in making our communities more disaster resilient. In the 2021 global IISD study *How Can Investment in Nature Close the Infrastructure Gap?*, it was found that NBI projects can represent a 51 per cent decrease in investment and 28 per cent gain in added value over traditional grey infrastructure.

This is not news to Nature Force program partners Aviva Canada, CNA Canada, Definity, Gallagher, Gore Mutual, HUB International, Intact, Navacord, Northbridge, SGI, Travelers Canada, Trisura, Wawanesa, Westland and Zurich Canada. Members of the Canadian insurance industry have been proactively investing in predictive modelling tools, research, and policy advocacy in the area of climate resiliency and flood attenuation for some time.

"What sets the Nature Force initiative apart is that we're coming together as the leaders of the Canadian insurance industry and funding community-based

natural infrastructure projects in urban adjacent areas and upstream watersheds in the Fraser Delta area of British Columbia and the highly settled regions of Ontario and Quebec," says Tina Osen, president of HUB International Canada.

"We are so pleased to be able to participate in this initiative with such an impressive collective of forward-thinking insurance organizations," says Larry Kaumeyer, CEO of Ducks Unlimited Canada. "Together I am confident we'll be able to influence landscape level change while showcasing the value of wetland conservation as a critical part of the solution for climate change adaptation."

The project planning process will commence in April 2022 in conjunction with public and private sector partners and local stakeholders. Indices and modelling tools developed by academic partners and the Ducks Unlimited Canada research institute will be used to prioritize projects based on considerations like flood risk and impacted population size.

This landmark initiative comes at a time when the Canadian government is signalling that they will be taking more aggressive steps towards modernizing the approach to disaster management. These actions include the prioritization and development of comprehensive flood mapping on a national basis to be made publicly available and the formalization of a national insurance program in partnership with the insurance sector to support high-risk properties which don't



# What do wetlands *really* do for our water?

## They help protect us from flooding.

**CASE STUDY:**  
CAMROSE CREEK, ALBERTA

Research shows that wetlands, serving as natural infrastructure in this Alberta watershed, provide ecosystem services and environmental benefits at an estimated value of:

- \$1.25 million in flood protection
- \$1.8 million in social benefits
- Approximately 900,000 tonnes of carbon stored

## They clean it.

**CASE STUDY:**  
ST-PIERRE-JOLYS, MANITOBA

When the town of St-Pierre-Jolys began using a wetland to clean water flowing from its lagoon, water tests showed that phosphorus levels dropped significantly.

- Phosphorus in the lagoon water was more than 70% higher than allowed by provincial guidelines.
- On average, the wetland reduced phosphorus load by 60%, bringing it well below the concentration allowed by provincial guidelines.
- The phosphorus in the wetland-treated water was lower or more diluted than the river water it was released into.

## They protect rivers and lakes from algae blooms.

**CASE STUDY:** SOUTHERN ONTARIO

Research near Lake Erie has shown that restored wetlands are effective at removing excess nutrients that can fuel blue-green algae outbreaks. Wetlands in the study all received surface-water runoff from agriculture fields. Findings showed the wetlands:

- Retained 60% of soluble reactive phosphorus.
- Retained 46% of total phosphorus and 47% of total nitrogen



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reasonably qualify for traditional flood insurance.

“These tools are much needed, but the greatest economic gains will come from the development of comprehensive wetland conservation and loss offsetting policies. Together, they will reduce financial risk by keeping water in our natural wetland basins where it belongs and restoring capacity from those habitats that have been lost or degraded,” says Kautmeyer. Predictive climate modelling tools are powerful and can help inform conservation priorities as well as land-use planning policies, but their use should

ideally be incorporated into a platform of integrated wetland management. Implementing standardized tools for calculating the full ecosystem service value of wetlands including climate change mitigation (carbon sequestration), climate change adaptation (disaster resilience), water quality, and supporting biodiversity would lead to better decisions. These tools should be leveraged as part of a holistic approach to land-use planning with a goal of ensuring there is no net habitat loss, that priority wetlands are conserved, and that offsetting policies focus on net ecological gains.

Ducks Unlimited Canada has been operating for over 80 years and has a conservation portfolio exceeding 11,000 projects and has conserved or restored over 6.6 million acres nationally. The body of research conducted through the organization’s research institute combined with the tremendous breadth of work on the ground has resulted in a highly effective blend of research and applied science.

“Our knowledge base has changed and our reality has changed,” says Gloutney, adding, “we now have a better understanding of the climate change risks our communities face and the comprehensive suite of ecosystem service values that wetlands deliver and our decisions need to reflect this.”

At a time where we face the dual crises of climate change and biodiversity loss, nature-based solutions have proven to be powerful tools to defend against both while delivering economic gains relative to traditional alternatives.

*More information on the insurance industry partnership can be found at [thenatureforce.com](http://thenatureforce.com). wc*

Source: Ducks Unlimited Canada

The cost of severe weather-related insurance claims is expected to more than double over the course of this decade, hitting \$5 billion annually.



PEOPLE



ALICIA FRASER

The Ontario Clean Water Agency (OCWA) has appointed a new president and CEO. **Alicia Fraser** assumed this new role March 31, 2022. Alicia, who was previously OCWA’s vice president of Operations, South Peel (Peel Region), succeeded Nevin McKeown as he retires after 30 years with the Agency.

“Alicia’s significant background and expertise in engineering and operations has served our clients and the Agency well throughout the years and we are excited to see her expand her leadership role within the Agency. Alicia not only understands the importance of delivering great service to our partners, but also the value of supporting and advancing innovation within the water and wastewater industry. We look forward to working closely with Alicia to continue

to help build healthy and sustainable communities,” said Joe Pennachetti, chair, OCWA Board of Directors.



LEE SCARLETT

It is with heavy hearts that we share the passing of **Lee Scarlett**, Water Canada’s former associate publisher. Lee lost his courageous 19-year battle with brain cancer on Friday, February 4, 2022. An advocate for the environment and a warrior for all things water, Lee was a familiar friendly face at industry water conferences and tradeshows for eight years until 2016 when he left Actual Media to focus on his health. “Water Canada magazine needed a business development champion in 2008, so I reached out to the energetic and affable Lee, whom I worked with previously at ERIS. He immediately embraced the water sector and the

many wonderful people in it,” shares Todd Latham, President of Actual Media. He was like a brother to many of us who worked with him—fun and engaging, and keenly interested in helping water technology, consulting, and engineering firms advance their businesses. Despite his diagnosis, Lee was always positive and kind, and continued to stay engaged with the water industry and ‘his baby’ Water Canada magazine as its Water Ambassador. “I will miss his fishing stories and the many business strategy discussions we’d have at the pub. Lee was one of the bravest men I’ve ever known: never complaining and always looking to the future,” added Todd.

He will be missed by many.

Lee leaves behind his wife, Taline and children Taveen and Darren. An intimate celebration of life for Lee took place in Bradford, Ontario on February 11, 2022. Donations can be made in his name to the Sunnybrook Foundation. wc



An aerial photograph showing a stone-lined waterway or stream. The water is a deep blue color. A winding path made of grey stones runs along the edge of the water. To the right of the stone path is a grassy area with several people walking. There are some trees and bushes in the background.

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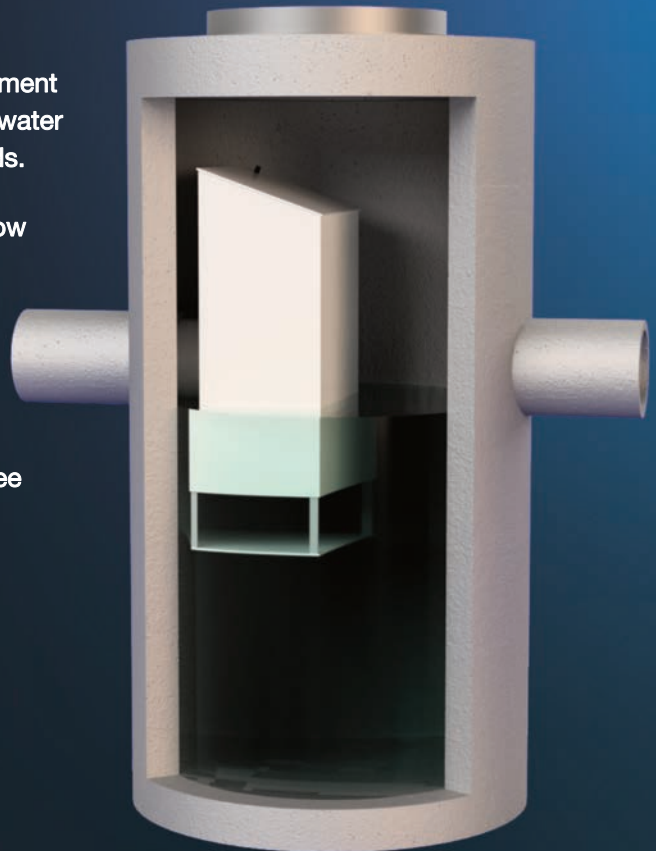
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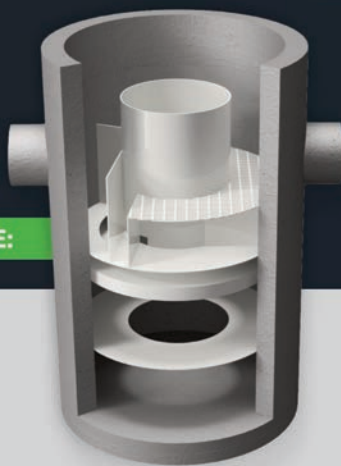
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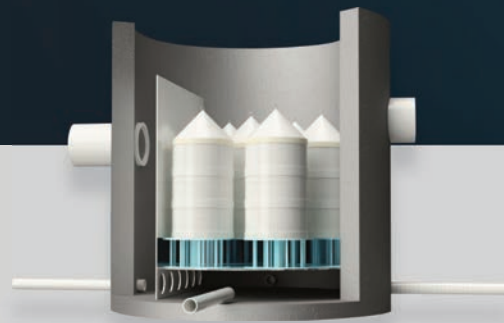


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