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Leave No One Behind

BY SIMRAN CHATTHA

IN CANADA, June marks National Indigenous History Month. The Government of Canada notes that this month aims to “recognize the history, heritage, and diversity of First Nations, Inuit, and Métis peoples in Canada.”

This year, National Indigenous History Month “is dedicated to the missing children, the families left behind, and the survivors of residential schools.” This is especially important given that the remains of 215 children were found at the site of the former Kamloops Indian Residential School in the current territory of Tk'emlups te Secwepemc.

The discovery of the remains supports the stories that have been told for years by families left behind. We mourn with everyone that has been impacted by this discovery and with everyone that has been impacted by the residential school system.

The discovery of the remains reminds us that colonialism continues to impact Indigenous communities. It also reminds us of the disparities that Indigenous communities continue to face, especially when it comes to accessing safe drinking water.

In May 2021, the Government of Canada noted that 53 long-term drinking water advisories were in effect in 24 First Nations communities. This information

takes into account that 106 long-term drinking water advisories have been lifted since November 2015. However, these numbers don't take into account the number of short-term drinking water advisories that are in place.

Our team at Water Canada recognizes that we don't have complete information about what Indigenous communities need to ensure that they have reliable access to clean, safe drinking water. As Kerry Black from the University of Calgary noted during the virtual Canadian Water Summit and Window on Ottawa in June, “the tip of the iceberg is what we know about the water crisis in First Nations communities.”

Water Canada's team is continually striving to ensure that we provide accurate coverage about what is happening, or not happening, in the quest to ensure that all Indigenous communities have reliable access to clean, safe drinking water. If there are particular topics you think are important to cover through Water Canada's print and/or digital platforms, please reach out to me at simran@actualmedia.ca. WC

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WaterCanada



ARIEL STERN
Ariel is a co-founder of Ayyeka.
PG. 14



YAIR POLEG
Yair is a co-founder of Ayyeka.
PG. 14



MARVIN DEVRIES
Marvin is the past president of Trojan Technologies
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MADJID MOHSENI
Madjid is the scientific director of the RES'EAU Centre for Mobilizing Innovation and a professor at the University of British Columbia
PG. 17

ABOUT THE COVER

In June 2021, Water Canada celebrated the individuals, projects, and technologies that received the 2021 Water's Next Awards.

Learn more on page 19.

Coming up in the next issue:
SEPTEMBER/OCTOBER

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Indigenous Water Insecurity



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Photo: Stephen Lambert / SOI Foundation

New Program Engages Youth in Sustainable Blue Economy

The SOI Foundation has launched Blue Futures Pathways, a program to inspire and support youth aged 14-30 across Canada in developing successful careers within the Sustainable Blue Economy. The program engages diverse youth, with an amplified focus on supporting under-represented, remotely located, and Indigenous youth.

“As an ocean nation with an ocean sector worth \$32 billion, the longest coastline in the world, and emerging, innovative nature-based solutions, now is the time to engage youth in the opportunities this presents, while instilling in them the knowledge and leadership skills to help preserve and restore Canada’s ocean and freshwater resources,” said SOI Foundation’s Founder and President Geoff Green. “The SOI Foundation aims to do just that.”

Central to Blue Futures Pathways is a digital platform called the PORT (Portal for Opportunities, Resources

and Talent). Available in English and French, the PORT provides a marketplace to connect youth, educators, and employers through educational and employment opportunities. It also provides information about funding related to the Blue Futures Pathways Internship and Mentorship programs.

Key features of the Blue Futures Pathways PORT include:

- A job board: Employers in the sustainable ocean and water sectors that are looking to hire youth ages 18-30 can post their jobs on the PORT at no cost.
- Learning resources: Available to youth and educators, the PORT houses learning resources to help youth navigate their role within Canada’s emerging Sustainable Blue Economy.
- Salary stipends: Youth that complete the Blue Futures Pathways Internship program and their employers can apply for internship or salary stipends. **wc**

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

Email Editor Simran Chattha at simran@actualmedia.ca



Update on Access to Clean Drinking Water in First Nations Communities

Indigenous Services Canada (ISC) provided an update on progress toward clean drinking water in all First Nations communities. As of May 17, 2021, 106 long-term drinking water advisories were lifted.

“We know progress cannot come quickly enough and one long-term advisory is one too many,” said Marc Miller, minister of Indigenous services. “One hundred and six long-term drinking water advisories have been lifted to date, and projects are in place to address each of the remaining advisories.”

Much work remains and projects are underway to address the remaining 53 long-term drinking water advisories in effect in 34 First Nations communities.

According to the Government of Canada, its commitment to improving access to clean drinking water on

reserves now and into the future goes beyond lifting long-term drinking water advisories.

“Our commitment to improving access to clean water on reserves does not come with a deadline, nor is it limited to our work to lift all long-term drinking water advisories. First Nations communities have now received the first installment of increased operations and maintenance funding,” said Miller. “These improvements will provide First Nations a predictable funding stream, which will assist them in making strategic plans for their communities.”

“We will not stop until every First Nation has clean water and we will continue to build the foundation for predictable, lasting solutions that support the unique needs of First Nations communities,” added Miller. *wc*

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REPORT: Significant Amount of Drinking Water Being Wasted due to Leaky Pipes. bit.ly/LeakyPipes



"It is not unusual for installations to accommodate settlement or for pipes to connect areas with hard foundations to areas with soft foundations," according to Chris Sundberg and Wayne Biery.

Plant Upgrades

New thinking is addressing performance challenges at wastewater treatment plants.

BY CHRIS SUNDBERG AND WAYNE BIERY

WASTEWATER TREATMENT PLANT upgrades happen all the time because owners are constantly improving efficiency, expanding capacity, and striving for better environmental stewardship. Not surprisingly, while the upgrades themselves are site specific, the issues encountered from one place to another are similar. Upgrades often have to accommodate pipes and components that have been in service for some time, and that can pose challenges. Add to that the need to manage movement from settlement, accommodate seismic events, and address corrosion, what appears to be a straightforward undertaking can suddenly become anything but simple.

Managing movement

It is not unusual for installations to accommodate settlement or for pipes to connect areas with hard foundations to areas with soft foundations. Most sites experience some level of settlement, and many need to accommodate movement or deflection.

Since the 1880s, Bolted Sleeve-Type Couplings (BSTCs) for plain-end pipe have been used to manage deflection.

Before welding was commonplace, BSTCs were used to join riveted steel and cast-iron pipe sections in the field. They could permit two to four degrees of static angular deflection when installed on short segments, which enabled changes in direction by creating a circular curve.

Since BSTCs cannot resist thrust forces, they require a harnessed joint that uses tie rods for restraint. The limitations of the harness make BSTC placement critically important because shear and bending forces cannot be accommodated safely without a harness. In addition, a lot of testing has to take place before BSTCs are buried to safeguard against leakage when the couplings are no longer easy to access.

When welding became commonplace in the 1930s, fewer installations used BSTCs because the same—or better—performance could be achieved more efficiently by deflecting welded joints. More recently, bolted split-sleeve couplings, which can be installed quickly

without welding or any special tools or equipment and can reliably deliver a broader range of movement, introduced a third option.

On a recent upgrade to the Clover Point Pump Station in British Columbia, the anticipated movement of the piping system posed a serious challenge. The stainless steel piping in the pump house had to be connected to the high density polyethylene pipe (HDPE) pipe that was being installed as part of the upgrade.

As performance expectations change, it is important for processes and components to evolve.

The connection area would be exposed to a high, cleaving load that could not be accommodated by an M11 harness. Welding would not only have produced slag and introduced other safety risks but would have negatively impacted the project schedule.

Using a grooved settlement joint reduced the forces on the piping,

allowing for settlement to take place without compromising the connection and eliminating a high bending load on the wall, which improved the structural integrity of the building.

HDPE pipe is being used in more applications because the give of the plastic introduces more flexibility and ductility, which makes it more forgiving when it comes to movement and vibration. In cases like this one, where stainless steel pipe is being joined to HDPE, the connection is critically important because HDPE expands and contracts at a rate greater than 10 times that of steel. When a settlement joint is required, having a reliable connection between the steel and HDPE is essential to the integrity of the pipe system.

The Victaulic Style W257 Dynamic Movement joint is designed specifically to accommodate movement in large-diameter pipe based on the movement expected to occur in the installation area over the life of the facility. With just two days spent at the site for rigging, this solution was installed in a single day with a small footprint. The rapid installation time meant roads could be opened at day's end, so disruption to residents could be minimized.

Seismic performance

Earthquake design has become important to cities in affected regions and is an area of focus for civil engineers. The building engineering community has taken note of the need for safer buildings, and regulations have been developed to ensure the integrity of aboveground structures. Recently, belowground assets have started to receive more attention from organizations like the American Society of Civil Engineers, which has developed a task force and an engineering group of around 60 people to study the issues and develop recommendations for dealing with buried pipelines. This is the first generation of study that aims to develop guidelines for developing seismically resilient products to improve safety.

For the Clover Point Pump Station project, seismic considerations were top of mind. Like many areas around

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the world, B.C. is seismically active so managing seismic events and anticipated settlement was only one piece of the dynamic movement puzzle. According to a Canadian earthquake tracking service, in a period from mid-March 2020 to mid-March 2021, B.C. experienced 558 earthquakes. While the range of intensity varied, multiple events in the course of the year were significant, registering 6.0 or higher on the Richter Scale. This level of seismic activity necessitates dependable piping solutions because system failures can damage the environment, compromise the safety of workers, and leave residents in the areas served by a treatment facility without service.

The availability of engineered large-diameter settlement joints to accommodate dynamic movement made it possible for engineers to specify the performance characteristics so the critical infrastructure components used at Clover Point perform reliably under extreme stresses.

Curtailing corrosion

The third common challenge owners must contend with is corrosion. Corrosion can be as damaging to pipe systems as movement and the repercussions can be as serious.

Historically, steel pipe has been the material of choice for most projects. Unfortunately, like all ferrous metals, steel is prone to corrosion if left unprotected. Coatings and linings routinely are used to decrease the effects of corrosion, but they can be costly. Even when a pipe is coated, the coating on the pipe ends is susceptible to damage when connections are being made up. The possibility of exposed, untreated metal increases the likelihood of corrosion. With a buried pipe, addressing corrosion damage down the road can be extremely costly.

Soils in the B.C. area are primarily gravel, sand, and clay, which are relatively aggressive in escalating corrosion. While welding the pipe joints at the Clover Point Pump Station Project

was an option, to ward off corrosion, the weld would have had to be smooth, which was a challenge given the diameter of the pipe. The coated, grooved coupling system contains fewer components and less bare metal than other solutions. More importantly, however, the exterior coupling geometry is designed such that it does not trap water, which significantly reduces the risk of corrosion. Ultimately, using Victaulic solutions that minimize the risk of corrosion is expected to improve the pipe system's longevity and reliability. **w**



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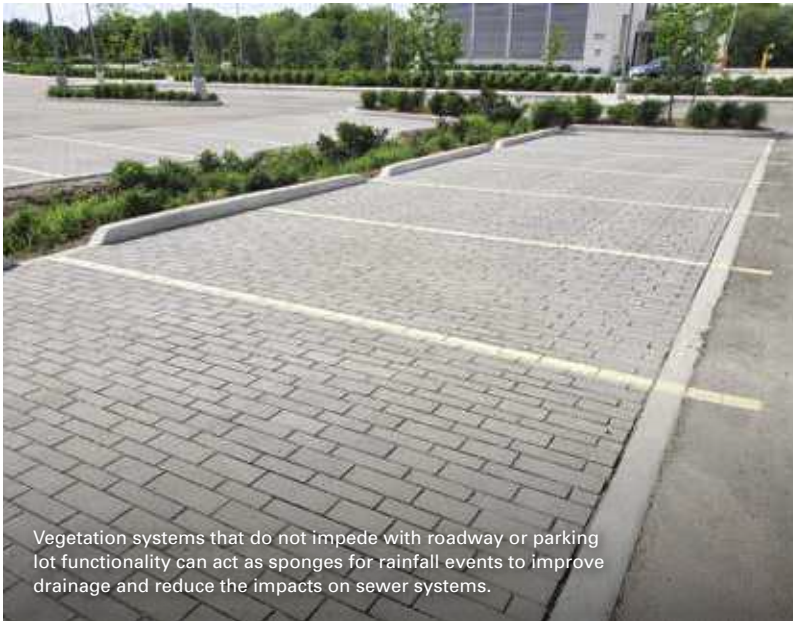
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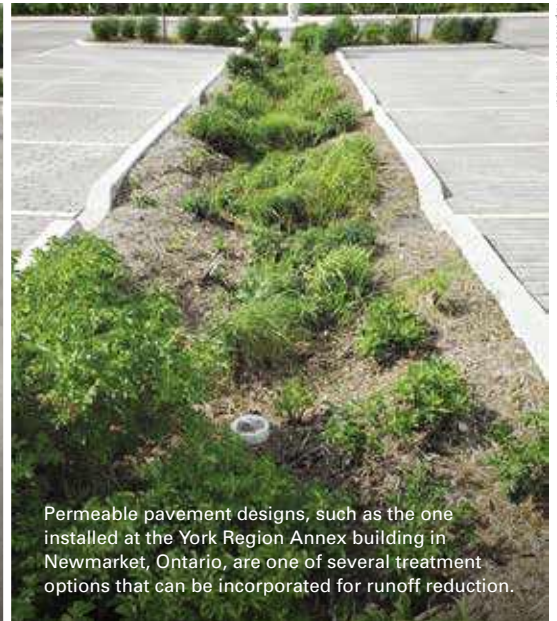
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Vegetation systems that do not impede with roadway or parking lot functionality can act as sponges for rainfall events to improve drainage and reduce the impacts on sewer systems.



Permeable pavement designs, such as the one installed at the York Region Annex building in Newmarket, Ontario, are one of several treatment options that can be incorporated for runoff reduction.

Creating Green Streets

A comprehensive new design approach for water treatment on municipal roadways. BY STEVEN VAN HAREN

WE NEED TO think differently about roadways.

Linear roadway and street corridors are often constrained in approaches to providing traditional stormwater management (SWM) measures. Yet these corridors can make up about 40 per cent of the urban area of a large city and contribute most of the dry weather pollutants that impact our lakes and rivers. Corridor widths are often standardized by municipal requirements and determined by the required number of traffic lanes and standards for boulevard design, not by SWM requirements. The demands of the trafficked area are such that integrated runoff management systems inside the road corridor that would best approach a source control definition are discouraged or very short lived. The items best suited to addressing runoff management, such as large trees, are often viewed as obstacles or impediments to traffic design and flow management or they conflict with utility requirements.

Green infrastructure approaches are a step in the right direction, but right-of-way dimensions and the required

roadway functions can limit their effectiveness. In addition, most green infrastructure design approaches to existing roadways are retrofitted, with all of the built-in limitations that retrofits bring. An alternate approach that incorporates street character, corridor setting, and vehicle and active transportation functions is required to ensure runoff impacts from these urban areas is addressed in a manner that doesn't impact the vehicle and active transport needs of the street users.

Distributed green infrastructure solutions in public rights-of-way also bring additional benefits to the corridor in the form of new vegetation supporting urban pollinator habitat, increased urban biodiversity, and reduction in urban heat island effects. These benefits tend to be overlooked when developing a desktop design analysis focused on a narrow set of design issues.

Designing Green Streets

The Green Streets design approach that has been developed for the City of Toronto moves away from the concept of collecting roadway runoff with a storm

sewer system and moving it to a central location, such as a SWM pond, as the only method to address precipitation impacts. It also removes the idea that certain classifications of roadway should receive similar approaches based on a potentially limiting set of previously approved measures or standards. A newer method that systematically determines which approaches to use based on street "reaches" (from intersection to intersection), its setting, its character, the population it serves, and the functions it provides, presents an opportunity to "dial in" performance while passively supporting corridor vegetation that is often otherwise neglected.

The Green Streets design process is based on a capture of small but recurring volumes of runoff associated with common precipitation events (i.e., "rainwater management"). This is as opposed to larger, but less common storm events that deliver substantial volumes of precipitation in relatively short periods of time and require traditional drainage infrastructure (i.e., stormwater management).

The smaller volume but more

common precipitation events deliver the largest component of annual rainfall. As an example, in southern Ontario, approximately 95 per cent of annual rainfall falls in events of 25 millimetres (mm) or less rainfall depth. Of these, 70 per cent fall in events of 10mm or less. These events can be captured and utilized in multiple smaller scale areas along a street reach, before runoff is generated and directed to the public drainage sewers or receiving water systems. This can be accomplished using distributed low impact development or vegetative systems that fit with the roadway corridor but do not impede its functions. Think of it as a series of sponges. When exposed to the larger

The smaller volume but more common precipitation events deliver the largest component of annual rainfall.

storms, these distributed systems will simply overflow to the drainage system.

The Green Streets process overlaps with green infrastructure design in many ways but adds steps to preemptively determine appropriate measures that match street functions, avoiding pitfalls that create systems to interfere with traffic and active transportation performance.

Green Streets implementation

The selection process begins with an inventory of surface and subsurface corridor features compared with municipally-prepared mapping of its natural features, including soil type and identified flooding hazard zones. It then follows a long-list approach to available runoff reduction and treatment options that mesh with and complement the street's characteristics, resulting in a customized approach that integrates green infrastructure functionality into the street fabric. This process then leads directly into the conceptual design process followed by preliminary and detailed design and subsequent construction.

This approach was applied to Winnett and Schell Avenues in Toronto, two residential street areas with different street characteristics. Winnett Avenue

is a densely developed, one-way street with virtually no boulevard area and a constant southerly grade. Houses along the street have small front yards with numerous trees that will benefit from passive irrigation of road runoff in the street. Schell Avenue is a two-way residential street with relatively less density, but larger traffic volumes. Trees are fewer but larger, with larger turf areas in larger front yards. The process is helping to understand how the Green Streets process is implemented across varying street types, with extension to main thoroughfares, arterial roadways, and destination spots or "famous" streets.

At the north edge of Winnett Avenue, near a school block, where the boulevard area widened sufficiently, a bioswale treatment is planned for water balance and water quality treatment. It will be installed as a future project extension. Downgrade, where the street boulevard narrows and houses are present close to the street, a strip of permeable paving for parallel parking areas is being installed prior to oil/grit separator units for infiltration and water quality treatment. On Schell Avenue, the available boulevard area is elevated so a bioswale treatment for roadway runoff isn't feasible and another strip of permeable pavement for parallel parking was installed. Oil/grit separators will perform backup water quality treatment prior to discharge to storm sewers.

The results of the installation include a significant reduction of annual runoff volume—a 91 per cent reduction for Winnett Avenue, and a 60 per cent reduction for Schell Avenue. The results also include retrofitted water quality treatment—78 per cent and 88 per cent TSS removal on an average, annual basis for Winnett and Schell Avenues. One-hundred-year event peak flow rate reductions of 16 per cent and 17 per cent in Winnett and Schell Avenues, respectively, from pre-project rates due to pavement net impervious area reductions were also realized.

Making the case

There are types of roadways where the implementation of Green Streets can be most effective. Road corridors located in sandy soil areas are better suited to Green Streets as infiltration-based measures have the greatest cost-benefit ratio. Similarly, marquee streets and "destinations" can benefit from century-old trees in their boulevards that are passively supported by green streets approaches such as continuous soil trenches where each tree has a minimum soil volume availability. Roadways with large external drainage areas should bypass runoff from those areas around the Green Streets designs to avoid overwhelming them with runoff.

However, municipalities will require high quality background and characterization of their roadway assets to allow for a systematic evaluation of how to apply these measures.

Runoff reduction and use of available runoff for passive area vegetation support provide a greater return on investment from the perspective of reducing the urban heat island effect, avoiding future downstream infrastructure upgrade costs, and improving street character. Without those systems, the downstream receiving water systems will need to absorb those impacts.

Using a full-parameter consideration approach in designing a runoff management system that complements street functions is a challenging task, which requires thinking beyond the direct issue focus of drainage design. Each street requires a customized approach derived from a systematic consideration of its individual characteristics for each reach, rather than a standardized approach based on roadway classification (local, arterial, collector, etc.). The corridor setting will establish the potential of the Green Streets approach to be effective, but the systematic approach will ensure that each street can maximize its overall benefits and minimize its runoff footprint. WC



Steven van Haren, P.Eng. is a manager of land development/water resources at WSP in Canada.

The digital transformation of the water sector is here to stay. Water utilities need to take steps to ensure that they are protected against cyber attacks.

Cyber Security for Water Utilities

What can water utilities do to protect themselves from potential cyber attacks?

BY ARIEL STERN AND YAIR POLEG

JUST SOUTH OF THE BORDER, a water utility produces 20 million gallons of potable water daily. The water is dispersed through 1,000 kilometres of pipes for the benefit of 130,000 consumers. Vaguely aware of growing cyber security threats in the water industry, the utility invited a technology firm to perform a security audit.

From the comfort of his hotel room downtown, the “white hat” hacker performing the security audit successfully infiltrated the water network. A data logger transmitted information from a remote asset without encryption directly to the operational SCADA network. The hack took minutes and opened the door to the entire system controlling the water utility’s every action.

Shocked by the speed and ease at which the hacker gained access, this water utility decided to completely overhaul and modernize the network with an emphasis on both data communication and cyber security.

A decade ago, this interception would not have been likely. When industrial automation was first adopted by critical utilities, there was little reason to be concerned about cyber threats.

Industrial automation took place offline, disconnected from the rest of the world, and “in the fence”—within the utility’s facility. Cyber warfare was uncommon, with high barriers of entry for hackers. Within a water facility, cyber threats were not probable.

Today, water utilities are attacked by hackers on a daily basis. Many of these utilities use technology developed decades ago without any concerns for cyber security. While these automation tools may provide reliable services, they are extremely ineffective against cyber attack.

Who is interested in hacking water and what are they trying to do?

Water utilities are attractive targets for any hacker. As a critical resource, hackers in control of water utilities can demand almost anything to return control of the utility. Criminal hackers, government operatives, terrorists, “hacktivists”

with an agenda, or even just a bored individual with no other outlet for his or her abilities all have something to gain from hacking a water utility.

What hackers seek to do after gaining access to the water utility differs. The most common motivation is ransomware blackmail, untraceable when paid by

The process through which hackers gain control over a water system is the same.

bitcoin. Other hackers seek to deny service; by hacking into the system they can shut it down. Still others are interested in stealing sensitive data. Just think of the many credit card details for sale on the black market—water utilities contain that same sensitive data. Data manipulation, say changing the levels of chemical in the water, is another force driving cyber attacks. As is publicity. Hackers who publicly expose their control of an important system to gain fame and prestige.

The water sector is vulnerable to any of these types of cyber attacks. Water utilities pay ransomware quietly several times a week. With no reporting requirements, this cost is quietly passed down to the consumer. Cyber attacks targeting data in the water industry are more dangerous. Shutting down a water network responsible for such a critical service would result in devastating consequences. Manipulating data within the network prompts unbalanced reactions, possibly causing the utility to poison the water itself. All the more reason for water utilities to prioritize cyber security in their systems.

How do hackers gain access to the water network?

While the reasons and identities of those attacking water utilities differ, the process through which hackers gain control over a water system is the same. A hacker's first move is to

identify the weakest asset within the network to attack. Any attack depends on this initial toehold into the system. Once that opportunity is identified and targeted, the entire system is at risk. For example, if the hacker's target is the water utility's well-protected SCADA system, a hacker may gain access through a seemingly harmless transmission from a remote device in the field, opening an innocent looking email, or upgrading standard software.

This initial vulnerability in the system makes an entire cyber attack possible. Quietly, without raising any red flags, the hacker works his or her way through the network, encrypting the water system's data until only the hacker has control of the water utility. This may take up to a week, depending on the size and complexity of the water network. When only the hacker has the tools to decrypt the system, ransomware can be demanded, or data manipulated.

Can utilities protect themselves by excluding technology?

If technology opens the door to potential threats and cyber attacks, why bother? Perhaps a more cautious approach is necessary? Regrettably or not, the digital transformation of water utilities is here to stay. Without technology and digital tools, there is no way water infrastructure can meet current demand, and definitely no way to provide enough water in the future.

The water industry faces numerous challenges. Aging infrastructure, growing populations, and extreme weather test the limits of water utilities daily. Automation and digitization allow water utilities to extend the lifespan and abilities of such critical infrastructure. Technology allows utilities to maximize existing resources, despite many challenges.

The water industry's future relies on technology. Big data generated by IoT devices brings new insights to hydraulic models. Furthermore, Infrastructure 4.0 brings artificial intelligence to edge devices

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in water mains to attain new operational abilities and extend the lifespan of aging hard infrastructure. There is no way to avoid technology if water utilities are to meet tomorrow’s needs. However, technology must be adopted in a cyber secure manner.

Zero trust cyber security for critical utilities

Historically, water utilities only had full visibility of “in the fence” actions. In other words, whatever was happening in the water plant. Many water utilities today have a historic approach to cyber security; a “perimeter” approach focuses on security for the water treatment plant but no concerns for assets in the field.

Industrial IoT provides data from the rest of the network, the thousands of kilometres of water main pipes, dozens of pressure release valves, and storage tanks—all the components previously operating blindly. This visibility and situational awareness of the complete water network enables

the quick, precise detection of leaks and monitoring water quality throughout the water network. However, this sophisticated solution is comprised of many components. Each of these components is vulnerable during a cyber attack.

The critical, initial cyber security breach could target any one of these components: sensors, meters, transmitters, servers, software platforms. Each is a potential vulnerability. Additionally, every interaction between components is a possible vulnerability. The only way to maintain security is to make sure each component is secure. A zero trust approach focuses on securing not only the central water plant, but also all the interconnected assets in the water network. After all, the water network is only as secure as its most vulnerable asset.

Cyber security for water utilities requires a double focus: secure architecture and security updates. The architecture and foundation of the network must be designed with security

in mind. Additionally, all hardware and software on the network must be constantly updated to meet the latest security vulnerabilities.

Going forward

Mitigating cyber threats is a constantly evolving process. With over 50 new cyber threats reported daily, responsible water professionals must be aware of the basic security issues surrounding this critical service. Choosing the right technology that provides both functionality and security is key.

Cyber attacks could happen to anyone but are most likely to happen to the least protected. Utilities are high profile and important, making them attractive targets for hackers. Keeping up with ever-evolving cyber threats requires ongoing effort. **wc**

Ariel Stern is a co-founder of Ayyeka.

Yair Poleg is a co-founder of Ayyeka.

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Transformational change is needed to ensure that Indigenous communities have access to safe, reliable drinking water.



Transformational Change

Whose job is it to create an effective national strategy on First Nations water issues?

BY MARVIN DEVRIES AND MADJID MOHSENI

OVER THE PAST DECADE, Canada's federal government has focused significant attention on First Nations' water problems, first by recognizing the challenge in 2011, then prioritizing the end of long-term boil water advisories in 2015. However, it has fallen short in responding. In 2021, we are still waiting for conditions to be put into place that will allow for transformational change to actually happen.

The responsibility, however, may not be government's alone. But who can we rely on to make it happen?

The context of a national strategy is shaped by whether its policies and programs are justifiable solely to those directly affected, or whether these investments must be defended in terms of their impact on the economy, technology, or another outcome that will benefit the majority of Canadians. However, when a branch of government is dedicated to serving a specific segment of the population, an innovative method for reconciling these two views is needed.

Transformational and sustainable change does not arise simply from a decree by government that is backed by policy changes and/or positive or negative incentives. Nor does it come about via knowledge generated by academia alone, or through a push by industry to refine product offerings. At the same time, industry practices need to be redefined to strengthen the capacity

of government to facilitate responsible regulations, producing social impact in a cost-effective manner. Market forces may produce more cost-effective and more innovative solutions (economies of scale), but that alone will not provide an acceptable solution to the problems rural communities are facing. In other words, the industry-government relationship is a two-way street.

Nor will transformation be achieved solely through advocacy and by casting the national spotlight on Indigenous inequities. Not all corporations or governments are equally vulnerable to public disapproval, and different ideological orientations are unlikely to agree about what counts as appropriate corporate social responsibility goals and practices. Case in point: In the mid-1990s, both Disney and United Airlines faced public boycotts, the former for providing health benefits to gay partners of employees, the latter for not providing them.

The real elephant in the room may be corporations and governments who are often lauded for one aspect of the way they do business, despite the negative impact of the other things they do. While Canada was busy failing Indigenous communities on water health, it was ranked #1 or #2 among nations six times between 2012 and 2017 by RepTrak, a

prominent U.S. think tank. The ranking was based on the perceptions of effective government, progressive social and economic policy, ethical practices, responsible global citizenship, and our operating efficiency. In the early 2000s, Microsoft was highly ranked as one of the world's top corporate citizens (thanks largely to the work of the Gates Foundation), despite several legal decisions against their unfair business practices throughout the decade. During the same period, Costco raised earnings and profits but saw shares devalued by Wall Street over concerns the company paid employees too much and offered

Transformational and sustainable change does not arise simply from a decree by government.

them health and retirement plans.

Neither are "the people" necessarily invested in the right issues for the right reasons, as when one is pleased when our Registered Savings Plans (RSPs) rise in value even if they may be invested in corporations who don't necessarily comply with one's worldview. It is also deceptive to expect a new generation of more socially committed managers to move into positions of responsibility, as their different ideological orientations

are unlikely to agree about what counts as an improvement in corporate social responsibilities. This suggests strongly that we have not entered a new era of business morality, let alone of true corporate social responsibility.

The underlying question we seek to answer is: what incentive system needs to be enacted for industry, universities, and NGOs to make appropriate investments and play their respective role in the evolutionary path that Indigenous communities seek to follow? How can governments at all levels create a fertile and supportive environment for transformational, sustainable change?

The process of identifying a sustainability challenge and implementing solutions is far from trivial. It demands a much deeper understanding than we

Governments must re-assess existing rules, while streamlining the implementation of localized customizations of solutions.

have at present of the processes through which fundamental transformation could happen in effective and efficient ways. It requires the identification of enablers and hindering factors underlying the success of transformational processes, and an understanding of which approaches might work under what conditions. Prevailing historical guiding principles and practices that are incompatible with shared values, beliefs, preferences, and definitions of success must be reduced or eradicated in order to build resilience and sustainability into a meaningful innovation cycle.

Thinking locally, acting nationally and collectively

When it comes to infrastructure projects, local governments must do three key things for their communities: advocate for the solution, acquire it, and own it. Achieving these factors requires a wide spectrum of inputs and outputs:

- An awareness of community history and vision for the future.
- Evaluating resources and obstacles to success.

- Discovering value opportunities.
- Procuring and onboarding technologies and talent.
- Demonstrating effectiveness and value for money.
- Celebrating success.
- Defending decisions.

These things translate into expectations, experiences and memories, which in turn put pressure on functional silos within industry, government, professional associations, universities, NGOs, and media.

We advocate that sustainability should be seen through the lens of breaking down the silos among these players to help the local community governments to do those three things better. Our point of view, based on years of experience innovating with rural communities, is that community acceptance is the primary metric by which all attempts at problem-solving should be measured.

Too often, a superficial understanding of what constitutes community acceptance, sets projects on an ill-fated course, one which typically becomes evident long after the contractors have packed up and left the community. Memorable experiences are those details that are retained at least 18 months after communities' most recent interactions with industry. Memorable experiences that enable communities' self-affirmation, which drive confidence about their selection decision and the value they derive from it, can help build lasting community acceptance.

What needs to change?

Our community-centric work with Indigenous communities has taught us much about what we could all be doing better, which involves implementing several short- and long-term changes to create the evolution—and revolution—we seek.

In the short term, we desperately need to revisit how Request for Qualifications (RFQ) and Request-for-Proposals (RFP) are structured to ensure equitable outcomes and experiences within partnership structures collaborating with Indigenous communities. The “win” in the

end must be for the individual community, but contributing partners must also find victory in the collaborative process.

Also, the practice of awarding contracts to the lowest-priced bid in design-build approaches to infrastructure projects does not address or strengthen social and technical capabilities that shape local capacity development within Indigenous communities. Furthermore, very little faith in the project is engendered when one-year warranties and operation budgets are the norm. The bottom line: sustainable development currently has no place in reporting requirements in conventional RFQs/RFPs, and it is time for the modification of federal and provincial funding provisions, as well as recommendations for infrastructure development practices, to mitigate sustainability.

Over the long term, governments must re-assess existing rules, while streamlining the implementation of localized customizations of solutions. They can do this today by creating space to try out new legal frameworks, business models and regulatory requirements so we can identify knowledge and next practices that support forward-looking solutions under real-life conditions. We also need to have space to experiment with new incentives around the feasibility and effectiveness of proposed solutions, and to support capacity building for factual cross-organizational and cross-disciplinary community-driven collaborations.

The aim of these approaches is not to deregulate the process or reduce standards. On the contrary, there are many areas in which there is legal uncertainty and for which meaningful legislation has yet to be created. Streamlining the implementation of localized solutions would be an important step toward ensuring that Canada lives up to its promise to respond to what it has prominently recognized and prioritized. **wc**

Marvin DeVries is the past president of Trojan Technologies. He is currently a Board member of the RES'EAU Centre for Mobilizing Innovation.

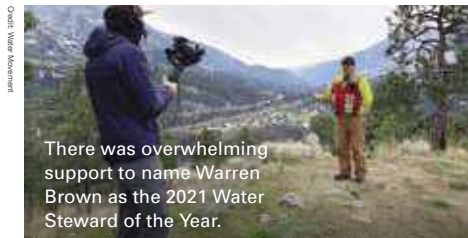
Madjid Mohseni is the scientific director of the RES'EAU Centre for Mobilizing Innovation and a professor at the University of British Columbia.



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

water's next awards 2021

Celebrating Canadian water leaders and champions



Credit: Water Magazine

There was overwhelming support to name Warren Brown as the 2021 Water Steward of the Year.



Credit: LuminUltra

LuminUltra was selected as the Company of the Year for its solution that aims to help keep our communities safe from viral threats.



Credit: PICA Corp.

PICA Corp.'s Bracelet Probe was selected as the winner in the Conveyance category.



Credit: Maddy Leburne

Amy Weston (in the middle) doing habitat restoration training.



Credit: Chris Wilton

The Co-operative Stormwater Management Initiative (CSMI) was selected as the winner in the Stormwater category.

Welcome to Water's Next 2021

WATER CANADA MAGAZINE'S Water's Next Awards program is the only national awards program that honours leadership across the entire water sector—including public servants, young professionals, researchers, and technology providers.

Since 2010, Water Canada has hosted the awards to help strengthen and celebrate this national community of water leaders, champions, and innovators. We believe that it is important to showcase these accomplishments,

because so many of the accomplishments that our finalists and winners have achieved go unrecognized by the broader public.

Yet, our community knows that clean drinking water, healthy rivers, safe wastewater discharge, and tools to help communities understand water are precious gifts to society. Our hope is that these stories will inspire the next generation of water leaders and innovators.

This year, we owe the success of

the program to the 12 outstanding and respected water leaders who participated on our selection committee. From a pool of 70 nominations, they identified 38 finalists and 15 winners that demonstrate a great breadth of knowledge and experience.

Thank you to the nominees, finalists, and winners for what you bring to the sector, for your vision, and persistence to protect our most precious resource. We proudly celebrate you in these pages. **wc**

A HUGE THANKS TO OUR 2021 SPONSORS!



watersnext.com

[@WatersNext](https://twitter.com/WatersNext)

Örmeci (pictured in the middle) is a former Canada Research Chair and the current Jarislowsky Chair and Canada Research Professor at Carleton University.



© Carleton University

Academic Leader: Dr. Banu Örmeci

COVID-19 has brought many activities to a near halt. However, for Dr. Banu Örmeci, it's been an opportunity to extend her water detection work from polymers and algae to microplastics and the SARS-CoV-2 virus itself.

Örmeci, professor of civil and environmental engineering at Carleton University in Ottawa, is perhaps best known for her research team's work devising the only known real-time, in-line detection system to achieve polymer dose optimization.

"Polymers are widely used in water and wastewater treatment," Örmeci says, describing the water-soluble chemicals, which aggregate particles within a suspension of water and solids, as both expensive and toxic to aquatic life and people.

"Measuring polymer concentration is very complex," Örmeci explains. "In the lab, it takes us a week with an advanced set-up with expensive equipment." While Örmeci's team has already developed a system for treatment plants to measure concentrations in real time, efforts are now underway to automate the process without the routine involvement of plant personnel.

Örmeci and her team have also taken a similar approach with algae blooms, which are increasingly affecting Canadian waterways. "Basically, it's

the same technology (as polymer dose optimization). We're just using a different wavelength to detect algae concentrations in real time."

This measurement approach, designed to help water treatment plants monitor microalgae and cyanobacteria, has achieved commercialization with RealTech of Whitby, Ontario incorporating it into its UV-vis sensors. "We took the instrument and created a new application for them," Örmeci says. "Before, they could not measure microalgae concentrations in real time, and now they can."

In fact, the system goes beyond measuring algae concentrations, tackling additional yet related water parameters such as dissolved organic carbon and nitrogen. "That's really important because algae grows in the presence of nutrients," Örmeci says.

While the pandemic has interfered with many routine activities, Örmeci's team has continued an Environment Canada and Climate Change funded project to detect and quantify microplastics in freshwater systems. "Plastics do not dissolve and disappear," Örmeci says. "They break up into smaller and smaller pieces, and research shows the adverse impact of microplastics not only on aquatic systems but also on human health. So we're helping Canadian companies develop products and technologies so they

can detect microplastics in water and wastewater samples."

Örmeci is even tackling the novel coronavirus. Her research group was among the first in Canada to work on wastewater-based epidemiology, monitoring virus levels in sewer systems in order to hasten the prediction of case numbers and spotting of trends.

Early results show strong correlations between sampling and case numbers in Ottawa. "It's important to be cautious, but we are seeing very good correlations with case numbers, and we can detect it a bit earlier than the clinical tests," Örmeci says.

While scientists and engineers can become isolated in their laboratories, Örmeci mentors female students at Carleton and organizes outreach events to convince young women in high school to consider careers in science and engineering. "A lot of girls who are really, truly interested in science and engineering and who would be so good at it are discouraged and never really explore it," Örmeci says.

Perhaps some of those young women will follow in Örmeci's footsteps and earn the recognition she and her research program have received from industrial partners, municipalities, utilities, and professional bodies worldwide. **wc**

— SAUL CHERNOS



Collaborating to combat COVID-19 through wastewater surveillance

Ryerson researchers are engaged in Ontario's Wastewater Surveillance Initiative to track the spread of COVID-19. This creative collaboration involves academic and research institutions working across the province in real time to help municipalities and communities monitor and manage the spread of the virus.

The Ryerson group is using molecular tools and wastewater analysis to track the virus in the sewage system and sharing their sample data with Toronto Public Health to identify the locations of early, possible outbreaks of the disease.

Professors Claire Oswald and Kim Gilbride are leading a team of 13 Ryerson researchers across environmental studies, engineering and biotechnology who have come together to develop and expedite solutions as part of the effort to contain the pandemic.

The majority of team members are part of Ryerson Urban Water (RUW), a multidisciplinary collective of research experts whose objective is to provide practical solutions to urban water challenges. Working alongside stakeholders from government, industry and community associations, RUW is implementing solutions to ensure a healthy urban water cycle.

Ryerson's Ontario Wastewater Surveillance Initiative Team

GEOGRAPHY AND ENVIRONMENTAL SCIENCE

Tor Oiamo
Claire Oswald
Lu Wang
Christopher Wellen

CIVIL ENGINEERING

Rania Hamza
Darko Joksimovic
James Li

CHEMISTRY AND BIOLOGY

Kim Gilbride
Martina Hausner
Stephanie Melles
Gideon Wolfaardt

David Cramb, Dean, Faculty of Science

Steven N. Liss, Vice-President,
Research and Innovation



During the time that Ben Kerr has been developing Foundry Spatial, he has also made time to support the broader community.

Business Leader: Ben Kerr

WHAT TO DO when freshwater data is buried in silos and not always accessible to parties affected by environmental decision making? If you're Ben Kerr, founder and CEO at Foundry Spatial in Victoria, you take an open data approach to automate the gathering and flow of information.

From modest beginnings in northeastern British Columbia, the company's water tools are gaining traction across North America, aiming to take publicly available environmental monitoring data and establish a single framework and platform where any number of users can quickly and efficiently understand the water supply and demand dynamics at their location of interest.

Kerr, a water resource professional, recognized that accessing and analyzing data from multiple sources is complex, especially if a watercourse has never been measured.

After striving to understand the factors hindering easy and equitable access to water data, Kerr assembled a team of environmental scientists, geospatial experts and programmers to develop information management tools that could be used to leverage online computing technology and scientific analysis.

"We don't actually go out and collect any raw data ourselves," Kerr explains. "We work completely as an aggregator generating insights off data other people and organizations are collecting."

The problem is that data is often held by different levels of government and even by researchers, consultants, commercial entities and citizen groups. "It's all over the place," Kerr says. "It ends up taking a lot of time just to do basic rudimentary analysis. So what typically happens is people don't do this for every decision. That's one reason you see problems around water management."

With an open-data approach, users are free to share data that has already been collected so long as basic considerations are met such as attributing original sources. Foundry Spatial's platform scours for water quantity data such as stream-flow, groundwater levels, precipitation and runoff, as well as quality data such as dissolved oxygen concentration, temperature, and chemical contaminants, and aggregates it in one place.

In California, the Nature Conservancy uses the system to assess conditions for sustainable water management for wineries and other large water users. "They might have water rights from the

1930s which say they can take this water during the summertime, but it might be better for the environment to take the water during the winter, when there's lots of water in the rivers, put it into a storage pond, and then irrigate from that storage pond during the summer," Kerr says. "Their challenge is getting through the regulatory hurdles to do that, and that can sometimes take years."

While Foundry Spatial is a business, Kerr contributes to the broader community. He's helped Friends of Swan Creek Watershed, a local stewardship effort, leverage the open-access tools. "The data they collect flows back into the system and is aggregated alongside other data that more than 50 other organizations are collecting as well," Kerr says.

Foundry Spatial is still a young company, so Kerr remains the backbone in terms of guidance, direction, and management. But employees cited their boss for granting them considerable autonomy and influence and inspiring them to take ownership of their work.

Kerr has also received outside recognition, including the BC Premier's Awards for Innovation, as well as a Global Petroleum Show Environmental Innovation Award. wc

— SAUL CHERNOS



Maharjan brings an unparalleled drive to his work.



Maharjan has engaged the City of Stratford, Town of Petawawa, and City of Cornwall in the Municipal Co-digestion Initiative.



Maharjan at the Getting to Net Zero Energy Wastewater event held by the Ontario Clean Water Agency (OCWA) in partnership with the Ontario Water Consortium.

Government Leader: Indra Maharjan

IT'S AN UNDERSTATEMENT to say that Indra Maharjan is passionate about his work.

As a senior engineer with an extensive history that spans energy conservation, climate change and resource recovery in the water/wastewater sector, Maharjan leads the Ontario Clean Water Agency's (OCWA's) Innovation, Efficiency and Technology group. He delivers innovative infrastructure solutions to over 200 municipal clients across Ontario. In doing so, he brings his first-hand knowledge of the challenges associated with municipal water/wastewater innovation, efficiency, and optimization to the task.

"Indra will readily admit when a technology doesn't meet an intended need," notes Jon Grant, chief commercial officer of SENTRY Water Tech "However,

to him, this isn't a failure—it's an opportunity to learn what other options are out there."

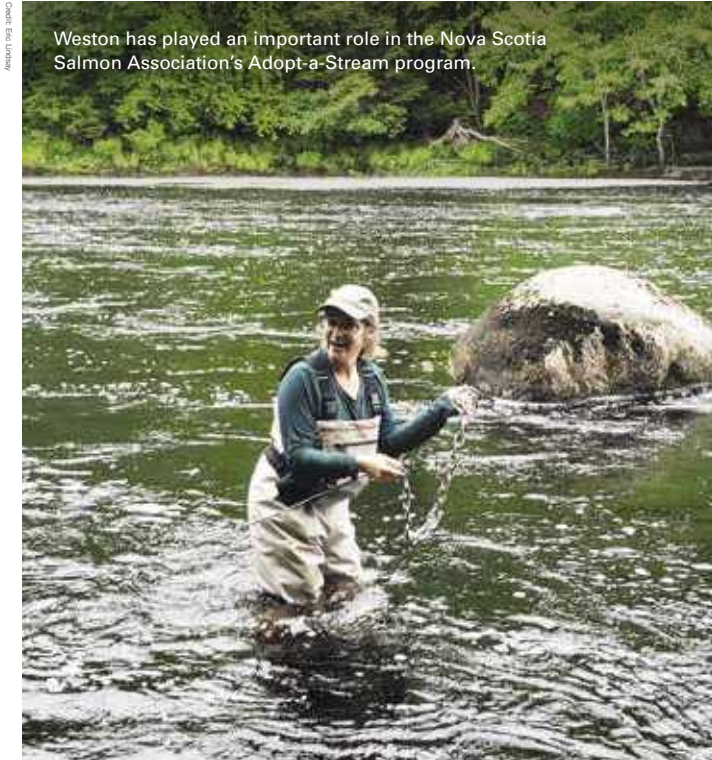
While the water industry tends to be risk-averse, Indra has been a true champion for trying new approaches that lead to positive outcomes. Indra developed and implemented the very first pay for performance energy program in the water/wastewater sector with support from Ontario's Independent Electricity System Operator. He has also been a driving force behind the Municipal Co-digestion Initiative that was showcased in the November/December 2020 issue of Water Canada.

Rahim Kanji from the Ontario Water Consortium notes that co-digestion "is a new concept in Canada." The work that

Maharjan has done in collaboration with OWC has created a new movement in the organics and wastewater sector. In doing so, Maharjan "brought municipal, electric, and gas utilities together to advance the goal of GHG reduction, clean fuel production, and circular economy."

The City of Stratford is one of the municipalities that has been involved in the Municipal Co-digestion initiative. Recently, Maharjan—along with a team at the Ministry of the Environment, Conservation and Parks—was awarded a 2020 Amethyst award for service excellence for a project in Stratford. The Amethyst Award is the highest order of recognition for excellence in the Ontario Public Service. **wc**

— EVAN PILKINGTON



Weston has played an important role in the Nova Scotia Salmon Association's Adopt-a-Stream program.



Weston at the DataStream kick off.

Non-government Leader: Amy Weston

AS THE HABITAT programs manager for the Nova Scotia Salmon Association's Adopt-a-Stream Project, Amy Weston works with more than 20 volunteer-based community groups across the province to support them in their efforts to restore fish habitat in their respective watersheds. The Nova Scotia Salmon Association's Adopt-a-Stream Project provides funding and technical support to help community volunteer organizations undertake projects to protect, restore, and enhance the aquatic and riparian habitats of local wetlands, lakes, rivers, streams, and estuaries in Nova Scotia.

"I take great satisfaction in the fact that over the past 20 years this program has resulted in 2.6 million square metres of freshwater habitat improvement, and the reestablishment of fish passage on 830 kilometres of rivers and streams in Nova Scotia," recounts Weston as she reviews her role in developing a comprehensive training program for workers and volunteers at the community level. "We have trained hundreds of people, and this increased human capacity represents a legacy that will continue to bring positive results for years to come."

A key initiative to the Adopt-a-Stream Project has been addressing aquatic

connectivity. Working with a few critical partners, the team started by creating a training program for the assessment of fish passage at stream crossings, particularly at culverts under roads. Then the team at Adopt-a-Stream began working out how to overcome some of the common problems being identified in the assessments, like hung culverts, high water velocities, and insufficient water depths for fish migration. Their work resulted in development of clear specifications for low-cost, prefabricated solutions to improve fish passage.

"The program has adapted itself, with Amy's leadership, to support community organizations that otherwise wouldn't have access to training or technical expertise to restore the critical fish habitat," according to Emma Wattie, director at the Atlantic Water Network. When the province created policies that would limit who could install critical restorative features such as digger logs, Weston and the Adopt-a-Stream team designed training that would make this certification more accessible to groups across Nova Scotia.

Weston is known to foster and mentor groups beyond project design and has supported data collection, assessments, report writing, and more. She encourages

community organizations to look beyond the fish habitat itself, and to take an ecosystem approach when it comes to project development. Weston brings a critical but constructive eye to provide feedback and alternative perspectives based on her extensive experience.

Most recently, Weston and the team at Adopt-a-Stream have been building a very large dataset of conditions in a number of priority watersheds. This involves extensive electronic monitoring of water temperature, detailed water chemistry, and collecting water samples for environmental DNA (eDNA) analysis, which can identify all aquatic species present in the watershed, ranging from insects to otters. This innovative new technology provides valuable data for prioritizing habitat restoration efforts, especially with regards to at-risk species.

Weston looks forward to the day when all poor road crossings will eventually be replaced with clear-span, open-bottom structures that truly provide full connectivity. In the meantime, more fish can more readily access many hundreds of kilometres of stream, thanks to the work of Weston and the Adopt-a-Stream Project. **wc**

— EVAN PILKINGTON

Credit: Water Movement



Warren Brown was asked by Water Movement to take part in some videos for a video learning library and documentary.

Inset: When presenting the Water/Wastewater Operator award to Brown, Actual Media's Todd Latham affectionately referred to him as a "Water Whisperer."

Water/Wastewater Operator + Water Steward of the Year: Warren Brown

"WARREN'S DEDICATION to operator advocacy is recognized not only by his community of Lytton First Nation, but also fellow colleagues in the water industry."

That's what Candance Cook, research engineer at RESEAU CMI, had to say when she nominated Warren Brown for the Water/Wastewater Operator award. The Water's Next Selection Committee also echoed Candace's sentiments, which is why Brown was awarded both the Water/Wastewater Operator award and the Water Steward of the Year award at this year's celebration.

As the operations manager for the community of Lytton First Nation, Brown is directly responsible for providing safe drinking water/wastewater services. He is also responsible for road maintenance for 13 drinking water systems.

While he juggles many tasks in delivering these services, they make up one part of the work he does on a day-to-day basis. Brown is an advocate for Indigenous water operators in Canada. His commitment to raising awareness of issues faced by water operators has

reached international news outlets, including the BBC.

In addition to regular requests for Brown to join committees and the numerous invitations to work with neighbouring Indigenous communities, his insight and expertise is sought by many high-profile academic institutions. Most recently, Brown was asked to be the host for a series of water operations training videos. These videos, in turn, have been distributed to Indigenous operators across Canada.

Beyond his day-to-day work, Brown never hesitates to assist community members with home repairs and maintenance. He often carves out time each day to give educational tours of his facilities to students and interested residents. Going even further, Brown recently developed a summer program to foster practical maintenance skills for youth participants.

"This job is not about money," comments Brown when reflecting on his busy work life. "I know I'm underpaid and will never be a millionaire. At some point, we realize our importance, and we do this work for our family and

community. I can sleep knowing I did the best I can, for them."

Brown works to inspire the next generation of water leaders and operators through dedicated outreach efforts. As an educator and mentor, his driving goal is to help others gain the understanding and skills needed to thoughtfully improve Indigenous water outcomes and become allies in advocacy.

His efforts have not gone unrecognized. With industry peers and coworkers appreciating Brown's growing influence in the greater water industry, his colleague, Candace Cook reflects that "the exemplary vision and leadership demonstrated by Brown has laid the foundation for operators to ensure that systematic problems and water inequities become a thing of the past in Indigenous communities."

In speaking to Brown one will quickly come to understand that his passion rests in working for his people. His stories do not touch on his own successes, but rather are filled with the pride he feels when those around him reach their potential. **wc**

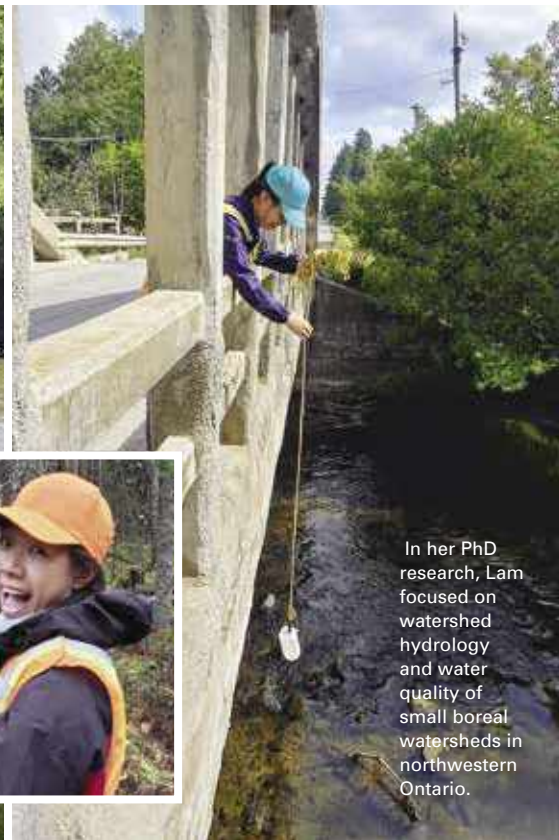
— EVAN PILKINGTON

Credit: Scott McKenzie, Toronto Centre for Youth Council



Lam is very enthusiastic during discussions about topics like access to water and natural spaces.

Inset: Lam has been an important part of the Toronto and Region Conservation Authority's Youth Council.



Credit: Scott McKenzie

In her PhD research, Lam focused on watershed hydrology and water quality of small boreal watersheds in northwestern Ontario.

Young Professional: Wai Ying Lam

WAI YING LAM has been a member of the Toronto and Region Conservation Authority's (TRCA) Youth Council since the program's inception in 2018. She has been working diligently to engage youth in environmental and water issues, including an emphasis on the importance of diversity and inclusion in conservation and the outdoors.

Lam's true passion for water-related work shines in her efforts to communicate, mentor, and inspire other youth to act. Her work with the TRCA Youth Council has always been designed with the youth community in mind. She has used her advanced communication skills to translate complex scientific theory and break down complex social issues for a broad audience. Using these talents, she has made great strides with the TRCA Youth Council in elevating the youth voice by hosting a number of in-person and online events.

Lam has also been a driving force to keep the Youth Council engaged during the COVID-19 pandemic. Prior to the pandemic, she led a very successful

in-person event in partnership with Swim Drink Fish and Patagonia to highlight the importance of water issues in the Toronto region, including the value of recreation and maintaining healthy waterways for drinking water.

When asked why she has decided to work in the water industry, Lam responded "For the variety! The water industry encompasses so many fields that it feels like there's a lot for a young professional to explore. I've done work on water quality, stormwater infrastructure, and forestry and water, and feel like I've barely scratched the surface."

Lam has brought this enthusiasm to discussions she has led on the importance of access to water and natural spaces through the development of a youth-led webinar discussing environmental racism and access to the outdoors. This webinar featured youth speakers, and the content was youth created, with the goal of elevating and recognizing the youth voice and experience. Furthermore, her work in academia is punctuated with a keen interest in the communication of

scientific results to help support multi-sector partnerships in water science.

Lam is a PhD candidate at University of Toronto Scarborough. Her research is grounded in watershed hydrology and water quality of small boreal watersheds in northwestern Ontario (in the Dryden area). She also has equal enthusiasm for examining how multi-partner and industry-academic-government research collaborations can perform better by including more effective science communication and engagement.

In July 2019, Lam successfully defended her master's thesis entitled "Quantifying chloride retention in urban stormwater management ponds using a mass balance approach." She completed a master's at the Ryerson Urban Water Research Centre.

Looking forward, Lam hopes to continue to share her love for advancing water-related science through accessible engagement, education, and outreach initiatives that benefit underrepresented groups. WC

— EVAN PILKINGTON



PICA's interior bracelet.



PICA's exterior bracelet.



PICA Corp. staff conducting an inspection.

Conveyance: PICA Corp.

THERE'S PERHAPS nothing worse for a local utility than a sewage line failure. So, for Pipeline Inspection & Condition Analysis Corporation (PICA) of Edmonton, Alberta, it only made sense to identify defects in hard-to-reach sections of pipe while the line is still in service, before trouble bubbles upwards.

In most cases, pipe deterioration results from air and gas build-up in the interior, leading to concentrated pockets of corrosive hydrogen sulfide (h₂s) gas eating away at the metal.

"Eventually, the pipe will get thin enough that it will rupture," explains PICA founder and co-owner Dave Russell. "You'll have a sinkhole under the street and a lot of raw sewage bubbling up and running down the road."

The technology is meant for routine force main condition assessments. As its name suggests, PICA's Bracelet Probe essentially wraps around a pipe's exterior, adapting to any size of ductile-iron, cast-iron or steel pipe starting at six inches diameter. Using 16 high resolution sensors that cover a 10-inch-wide path, the probe penetrates through the pipe wall using a low frequency electromagnetic field to scan axially for signs of interior damage such as corrosion, thinning, pits, and cracks that

can cause leaks and ruptures leading to pollution and property damage.

As the Bracelet Probe moves along the pipe, it displays measurements, immediately transporting the data to a software platform for near-real-time access over a laptop or other computer.

PICA has achieved commercialization, with close to a dozen municipal utility users in the U.S., including Gwinnett County, a suburb of Atlanta, Georgia. Ironically, PICA has yet to land its first Canadian customer for Bracelet Probe. "I think Canadians in general are more conservative and don't jump on to new technology as quickly as US customers do," says Russell. "U.S. customers tend to be quick adopters of new technology."

While the Bracelet Probe is typically applied from the outside while the pipe remains in service, an internal version can be used when a line is empty and clean. The internal device functions much the same way the external probe does, except that it scans the pipe circumferentially, covering 24 inches axial length for each rotation and can be adjusted to fit a pipe's interior dimensions.

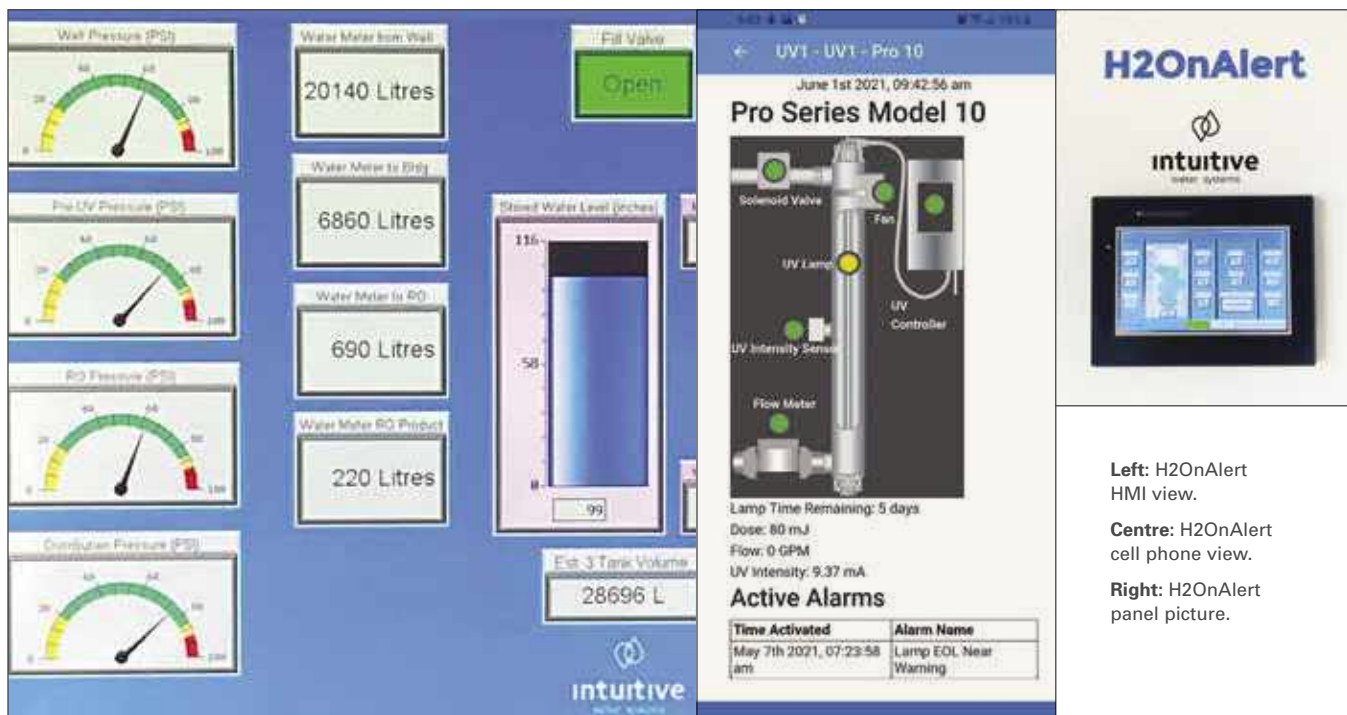
In 2017, the San Diego County Water Authority used the internal Bracelet Probe in tandem with PICA's Electro Magnetic Inspection Tool (EMIT) to

inspect many miles of its raw water large diameter pipelines. The Bracelet Probe was instrumental in this because it was able to inspect internal sections of pipe that were otherwise challenging to reach. So while the EMIT tool scanned the more straightforward long-lined stretches, the internal Bracelet Probe accessed the more awkward pipe bends near any bulkheads.

Data is stored on a hard drive as the Bracelet Probe moves along the pipe. The process repeats until all desired areas are scanned. Although the client receives preliminary data immediately, PICA provides a full report, including precise locations of areas of concern and wall loss percentages, when inspections are completed. Reports include 3D colour maps, strip charts and voltage planes to help clients understand the data and take action to spot-repair any wall loss detected.

Martin Coghill, operations and maintenance manager with the SDCWA, says his utility used the internal Bracelet Probe to identify, verify and repair several localized defects. "It allowed us to prevent failures in pipelines and implement repairs in advance of any problem." WC

— SAUL CHERNOS



Left: H2OnAlert HMI view.

Centre: H2OnAlert cell phone view.

Right: H2OnAlert panel picture.

Drinking Water: Intuitive Water Systems Inc.

WHETHER A PUMP has failed, a disinfection system needs a new bulb or faucets are running indiscriminately, a system that can warn small-scale commercial water users over a tablet, smartphone, or other portable device is no longer a pipe dream thanks to H2OnAlert.

Intuitive Water Systems—a Binbrook, Ontario engineering firm that designs, installs, and monitors commercial water and wastewater applications—was working to develop its own proprietary software platform when one of its biggest clients, a major Canadian fast food chain, expressed a desire to track its own water metrics.

Water monitoring systems have gained traction in recent years, and water treatment plants and other large-scale industrial operations have long had systems to warn them about impending disaster.

But Intuitive Water Systems was well positioned to develop an offering accessible to smaller customers. Its client base consists largely of restaurants, farms, and golf and country clubs—small and medium size businesses that consume lots of water and depend on its safety.

H2OnAlert has enabled this entire class of water users to view their own usage,

performance, and safety data. Records are maintained long-term so users can connect using a smartphone, tablet, or other handheld device and track measurements over time in order to spot and analyze trends for purposes such as water conservation and cost savings.

What stands out, however, is H2OnAlert's ability to dispatch emergency alerts in the event of system trouble or, in some cases, before trouble even fully materializes. A malfunction or need for routine, scheduled servicing automatically triggers an e-mail or text message with information outlining precisely what's going on.

The idea is to save money and time on costly repairs, lengthen the lifespan of equipment, and reduce issues with water quality, says Intuitive Water Systems founder and owner Mike Piotrowski.

"Businesses can have access to data and service reports and can focus on their operations rather than needing to continually check their systems or deal with problems after the fact."

Piotrowski tells the story of one client, a restaurant, that received an alert pinpointing a malfunction of its UV system and was thus immediately made aware of a sudden deterioration

in water quality. UV systems can even be monitored so that users will be notified when UV lights begin to fade, enabling bulb replacement before they go dark.

In another instance, a truck stop on a major Canadian highway experienced a well pump failure. With restaurants, showers and laundry facilities, truck stops are highly water dependant. While that particular location stores a short-term supply of water on site, the alert system nipped trouble in the bud and prevented an eventual shutdown.

"H2OnAlert doesn't necessarily say you need to replace a membrane, but it will tell you the problem area," says Piotrowski. "Instead of the user saying they've got no water and this box is buzzing, it helps troubleshoot with somebody who is physically there but doesn't know a water system."

H2OnAlert is used mostly for water systems, though a handful of users are also monitoring wastewater and effluent flow. The system is also intended for rural areas, where customers rely on private on-site wells and septic systems rather than municipal services. "Municipal water quality and supply are pretty consistent," explains Piotrowski. wc

— SAUL CHERNOS

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Alex Wachna, GIS analyst at ENWIN.



Bruce Ogg, water project review officer at ENWIN.



Marc Ethier, senior technical analyst at ENWIN.

PHOTO: ENWIN/ENWIN.COM

Early Adoption: ENWIN Utilities Ltd.

A WINDSOR, Ontario utility's need to improve its data entry process for backflow test results effectively turned a problem into an opportunity to streamline not only its own performance but offer other utilities the ability to do the same.

Backflow prevention valves protect public drinking water supplies from non-potable water entering the system due to sudden changes in water pressure.

ENWIN Utilities operates the Windsor Utilities Commission-owned water system. It was experiencing errors stemming from the manual entry of backflow test results.

With plumbers filling out paper-based work completion sheets and ENWIN processing them manually, the utility was experiencing a significant volume of spelling errors, inaccurate addresses, and incorrect backflow serial numbers. At a time when retirements were at an all-time high and utilities were striving to contain costs for customers, staff were wasting valuable resources searching manually for errors and correcting bad information.

ENWIN decided to automate the system and approached its key information technology provider, Esri Canada, for help with creating a map-based backflow program that would

eliminate manual entry, simplify user interactions and offer easy maintenance of accurate, permanent records for all locations where backflow valves are installed and tests undertaken.

ENWIN's project team, led by Bruce Ogg with assistance from Alexander Wachna in the utility's geomatics department and Mark Ethier from IT, oversaw the design process. Together, they worked with Esri to adapt its Geocortex software so that it would suit backflow data and mapping needs.

The end result is a password protected web site where plumbers and other external users, as well as ENWIN staff where applicable, can open a map of the municipality, click on a property, and follow a small number of drop-down menus to enter all required data.

"It's one of the first ever GIS map-based backflow programs anywhere," says Ogg. "I had a hard time finding anybody that had this."

The new process, beta tested in mid-2019 and fully launched later that year, eliminates manual input errors, shortens data entry and records creation processes, and produces accurate reports for internal monitoring.

External users have reported reductions of up to 90 per cent in data entry time. ENWIN reports 100 per cent

accuracy due to elimination of hand-typed data entry.

"Not only can plumbers now enter tests online in a minute, they don't have to submit a form to us and we don't have to keep paper records," says Ogg. "All those records are kept in our GIS maps."

While it's hard to quantify precise savings from this kind of effort, particularly with the program not in full gear due to COVID-19, ENWIN estimates annual savings of roughly \$50,000 in terms of data entry and correction costs under more normal circumstances.

While the program appears to be unique, ENWIN checked with other Ontario water utilities and discovered it wasn't entirely alone in experiencing backflow data integrity issues. The vast majority of them use GIS software that can be easily and inexpensively be adapted to an application system such as this.

That realization, early in the process, inspired the project team to set their sights on an application that could potentially be applied nationally and even internationally. Ogg presented the application's beta version to the National Water & Wastewater Benchmarking Initiative and has kept them updated on its progress. WC

— SAUL CHERNOS



Jay Famiglietti, host of the Let's Talk About Water (LTAW) podcast.

Education and Outreach: Let's Talk About Water

LET'S TALK ABOUT WATER (LTAW) is a growing platform for discussing water science in a manner that's accessible to as many people as possible, taking research out of the proverbial ivory tower and making it accessible through podcasts, social media, international forums, and film festivals.

LTAW discusses water-related issues vital to our collective wellbeing often before they make headlines. At the very start of the COVID-19 pandemic, LTAW worked with the Global Institute for Water Security at the University of Saskatchewan to produce a podcast highlighting the potential epidemiological benefits of monitoring SARS-CoV-2 in wastewater. This led to increased mainstream media coverage and even further scientific collaboration.

Through online festivals and awards programs, LTAW has promoted film as a medium for discussing water and its crucial role in the future of our planet. Films presented by LTAW have gained significant traction, with more than 13,000 views from nearly 40 countries.

LTAW's themed forums have been attended or viewed by more than 5,000 people globally, and youth engagement efforts have helped thousands of school-age children learn about water and climate science.

With the goal of reaching not only the public but to spur business sectors and policymakers to make informed environmental choices and effect positive change, LTAW has used social media to reach hundreds of thousands of people with more than 20,000 social media engagements and interactions recorded.

If LTAW has a keynote, however, it's the podcast hosted by Dr. Jay Famiglietti, a hydrologist and executive director of the GIWS with University of Saskatchewan, that's entering its third season.

Notable guests include world-renowned economist Jeffrey Sachs, a professor and former director of the Earth Institute at Columbia University in New York City. "He's a pioneer in thinking about the UN Sustainable Development Goals," says Famiglietti. "He's a great communicator, and we wanted people to understand the challenges for actually achieving sustainability in water."

UN sustainability goals might lack tangibility for listeners in a big city or busy with their own lives, but Famiglietti says people from all walks of life need to understand that climate change not only means increased weather extremes but stands to directly affect our food and water. "It's important for people to realize this actually impacts us personally, right

here at our faucets, right here in our mailboxes when the bill comes in."

The podcast speaks in different ways and at different levels. Famiglietti recently discussed environmental racism with Dr. Ingrid Waldron, a professor at Dalhousie University in Nova Scotia who co-produced the 2019 film *There's Something in the Water*, which is based on her book of the same title.

The conversation addressed efforts to tackle the fact that marginalized communities such as Black Canadians and Indigenous communities often bear the brunt of water pollution and climate change and are disproportionately affected by cancer clusters. "Educating the communities about their rights and putting pressure on elected officials to deal with these crises are all goals of having Dr. Waldron on the podcast," says Famiglietti.

Let's talk About Water is about communicating science to everyday Canadians and making it public and accessible, Famiglietti says. "I could be writing another research paper, but instead I'm devoting my time to this because I want to bring that scientific understanding, translate it, and make it understandable to a much broader audience." WC

— SAUL CHERNOS



The Western Irrigation District and five municipalities came together to form the Co-operative Stormwater Management Initiative.

Stormwater: Co-operative Stormwater Management Initiative (CSMI)

ACROSS A LARGE TRACT of land spanning the Eastern edge of the City of Calgary, the Town of Strathmore and Rocky View County there are limited natural drainage courses to effectively transfer stormwater. Ongoing development in these communities, which are adjacent to and surrounding the Western Irrigation District (WID) irrigation system, has been accelerating stormwater management challenges in the area. These include creating ongoing maintenance and water quality challenges for the WID and limiting the available options for new developers to safely move runoff away from their properties.

It was clear that a long term, sustainable solution for stormwater management was needed to help municipalities grow and develop land, while also maintaining water quality in the irrigation system that supports a vibrant agricultural economy and the long-term health of nearby water resources.

In 2012, the Western Irrigation District responded to this need and spearheaded an effort to bring together five partner municipalities to develop a regional stormwater solution, now known as the Co-operative Stormwater Management Initiative (CSMI).

The CSMI is a unique initiative that

will provide a process for ongoing collaboration between municipalities and the irrigation district for decades to come. Water flows across political boundaries, bringing people and organizations together to manage one of our most valuable resources. The overall sentiment reflected by the partners in this initiative seems to be that collaboration is key to the success of such a large regional project. Having all of the partners at the table with an opportunity to express their needs and desires, will be crucial to building the trust necessary to pursue solutions that work for everyone. The relationships built throughout this collaborative process will support continued economic growth, a vibrant agricultural economy, and the long-term health of regional water resources.

In addition to their collaborative governance model, the funding structure for this project is markedly innovative. Funding requirements for capital costs of the CSMI infrastructure will be raised by municipalities applying levies on new developments. Levies in the CSMI region will be collected by each municipality to help fund construction of future stages of the CSMI System.

As funds are raised through these levies, future stages of the CSMI system

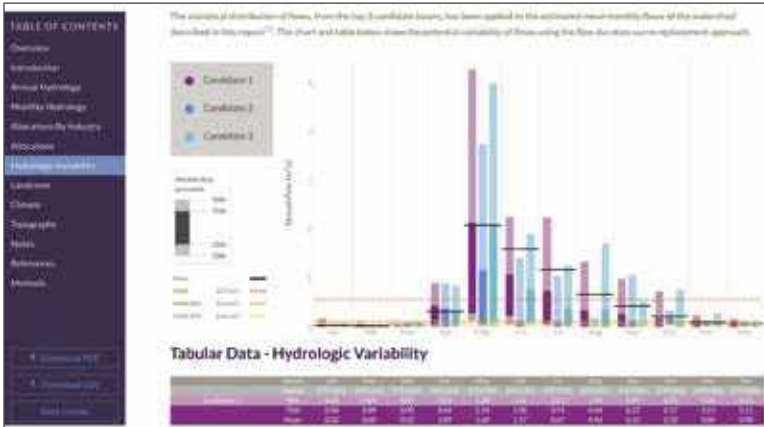
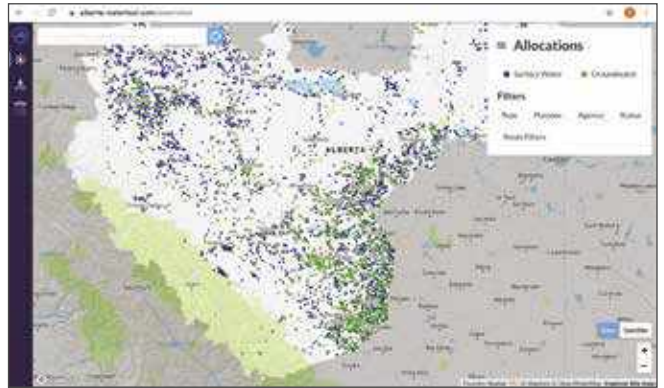
will be built to accommodate growth and new development. Municipalities collecting the levy dollars can use the money to help pay for municipal utility systems that directly or indirectly serve the development. Levies may be spent toward facilities such as roads, water lines/treatment/storage, sewage facilities, stormwater facilities, and other municipal services. It is recognized that long term sustainability of the CSMI stormwater system and a solution that truly benefits all partners equally relies on the advancement of future stages.

According to members of the CSMI, it has been immensely rewarding in the early stages to see the regional partners come together and collaborate effectively to develop the concept, then design and begin to build the system. This is an excellent example of an innovative solution to regional stormwater challenges that can be applied in other locations where multiple stakeholders share land and have drainage issues that are being exacerbated by development pressure.

The partners would like to thank the Government of Alberta and the Government of Canada for their funding support. Without their contribution this project would not have been possible. wc

— EVAN PILKINGTON

credit: Foundry Spatial Inc.



Top left: Halfway River, B.C.

Top right: Foundry Spatial Water Framework. (Alberta Water Tool)

Left: Foundry Spatial Water Framework. (BC Water Tool)

Water Resources: Foundry Spatial

THE TEAM AT Foundry Spatial Ltd. is hoping that with easier access to critical water-related data and reporting, a better balance can be struck between social, economic, and environmental needs. Scientific information on water supply and demand is often difficult to find, acquire, and understand. These challenges have an impact on decision-making and the outcomes are immediately visible in the world around us.

In response to issues such as water scarcity, degraded water quality, aquifer depletion, or saltwater intrusion, Foundry Spatial has developed the Water Framework. The Water Framework takes massive volumes of real-time and historic environmental monitoring data, specialized hydrology models and analytical routines, and delivers easy to digest insights.

According to Ben Kerr, founder and CEO, the first version of the Water Framework was developed to support Foundry Spatial's own internal needs. The company was hired as consultants to deliver large regional water resource evaluations that required gathering, processing, and analyzing water data from hundreds of monitoring locations.

Foundry Spatial's leadership team was faced with a choice—hire a team of junior environmental scientists to analyze the data manually, or hire software developers instead to automate the analysis and reporting in hopes of future efficiency. They chose the latter, shared the first version with a willing client, and haven't looked back since. Ongoing development is now driven by a combination of client demands and the incorporation of new analytical capabilities such as streamflow depletion from groundwater pumping and cumulative impacts of forest disturbance.

"Technology is an enabler, but shouldn't be the only focus of a project" says Kerr. "Fundamentally, ensuring high quality data, as well as understanding and successfully meeting user needs must always be top of mind."

With critical attention spent on optimizing the user experience, the framework provides accurate, reliable, and relevant information for any specific location of interest. In a matter of minutes, users can retrieve knowledge that would otherwise require costly consultants weeks, or even months, to produce.

Foundry Spatial's goal is to enable users from governments, Indigenous communities, and industry to make more informed decisions about watersheds and aquifers, and to better understand the impact decisions have on the local environment. The company has had implementations continuously running in Western Canada since 2014. The team is now entering a commercial push to roll out the technology into new jurisdictions, anticipating new projects in two US states by the end of 2021.

The biggest reward for the Foundry Spatial team has been hearing from users who've become better informed with the help of their powerful tool, and were able to take immediate action to resolve that problem. As Kerr reflects, "Poor water management can cause massive impacts. Helping clients to avoid these risks is core to the value proposition of our project."

Foundry Spatial seems poised to support balanced, resilient water management decision-making, ensuring that nature, industry, and communities can continue to prosper and adapt to our changing climate. **wc**

— EVAN PILKINGTON



LuminUltra Headquarters.

Credit: LuminUltra



“This solution can continue to be used for pandemic management within Canada and beyond,” according to Pat Whalen, chairman and CEO of LuminUltra.

Credit: Bang-On Photography

When LuminUltra was developing its solution, the company's focus was on simplifying the wastewater testing process. PICA's exterior bracelet.



Credit: Bang-On Photography

Wastewater + Company of the Year: LuminUltra Technologies Ltd.

SINCE THE OUTSET of the pandemic, many communities across Canada have been testing wastewater to predict potential changes in COVID-19 cases. To make it as easy as possible for communities to conduct wastewater testing, LuminUltra developed a rapid, accurate, non-invasive testing solution.

“Most of the available methods for doing this testing require specialized lab equipment and expertise, greatly limiting its potential use and extending the time it takes to get results,” says Pat Whalen, chairman and CEO of LuminUltra Technologies Ltd.

“Our innovation for SARS-CoV-2 wastewater testing is all about simplifying the process and bringing the technology on site,” adds Whalen. “The simplification means that it requires less technical expertise and specialized lab equipment that most wastewater plants do not have on

hand. And bringing the portable PCR device on site means that your results are available in two hours instead of waiting days for turnaround.”

For LuminUltra’s leadership in developing this solution, it was awarded the Wastewater award at the 2021 Water’s Next awards celebration. LuminUltra was also recognized as the Company of the Year.

“It is an honour to be recognized by Water Canada,” says Whalen. “LuminUltra is very proud to continue to be part of innovations and excellence in Canada’s water community.”

A few partners in the water community supported LuminUltra while it was developing its wastewater testing solution. The company found that having a good understanding of partners and customers is “crucial.”

“For us, it was about working with some key stakeholders including

Dalhousie University, Halifax Water, Suez, and Hach for a range of purposes,” says Whalen. “We were able to better understand what our customers needed to simplify their wastewater testing program, and what would help put this important testing to better use. These partners, combined with the expertise across our organization, have been at the core of our success to develop solutions best able to address the greatest needs.”

SARS-CoV-2, the virus that causes COVID-19, can be found untreated wastewater even if individuals are presymptomatic or asymptomatic. Communities can test wastewater for SARS-CoV-2 to better understand changes in COVID-19 cases. This information, in turn, can be used to support decisions being made by public health officials. **wc**

— SIMRAN CHATTHA

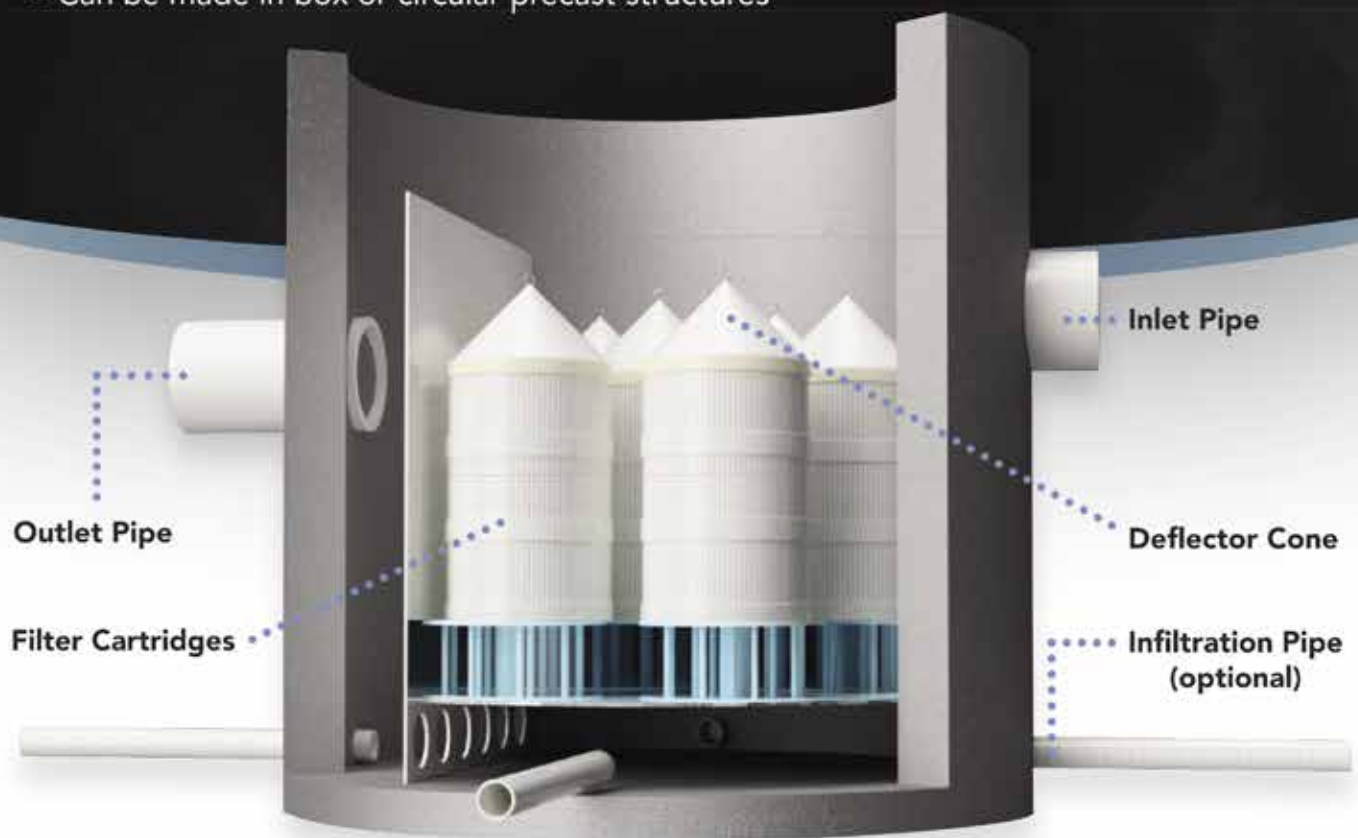
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