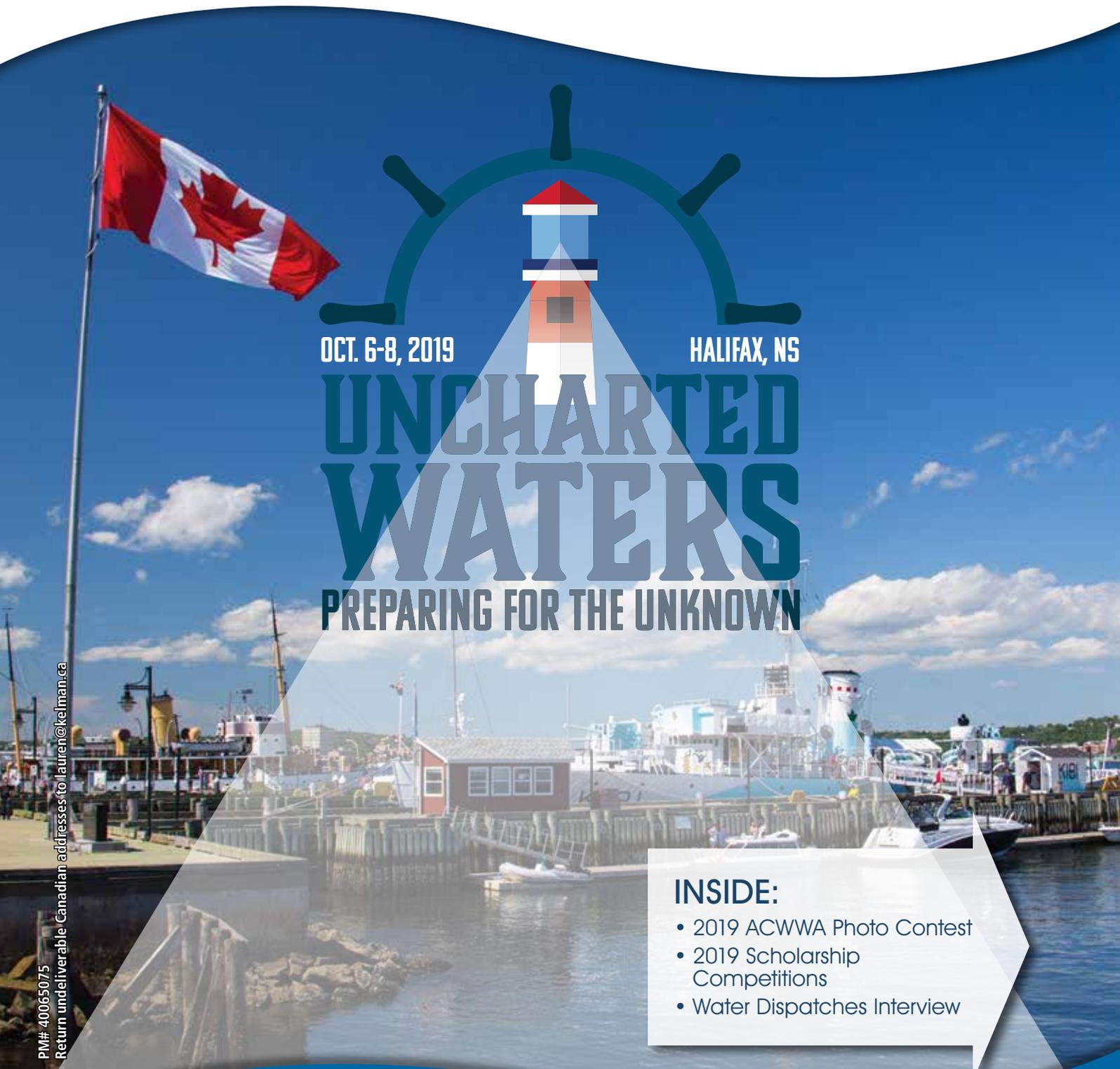


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- 2019 Scholarship Competitions
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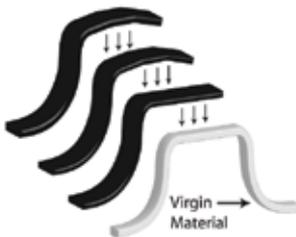
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Box 28141, Dartmouth, NS B2W 6E2  
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 contact@acwwa.ca www.acwwa.ca

**Section Office**

**ACWWA Executive Director**  
 Clara Shea contact@acwwa.ca  
 902.434.6002 F: 902.435.7796

**Board**

**Chair**  
 Jennie Rand, PhD, P.Eng.  
 jennie.rand@acadiiau.ca  
 902.585.1519 F: 902.585.1067

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 amyw@cbcl.ca  
 506.633.6650 F: 506.633.6659

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 brent.mcgovern@saintjohn.ca  
 506.658.4455

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Catherine Cameron  
 scotiotech.main@ns.sympatico.ca  
 902.468.2777

**Secretary-Treasurer**

Rob Gillis, P.Eng.  
 robg@halifaxwater.ca  
 902.497.1740

**WEF Delegate (2017-2020)**

Dave Galbraith  
 dave.galbraith@sansom.ca  
 902.895.0252 F: 902.893.7584

**AWWA Director (2017-2020)**

Graham Gagnon, Ph.D., P.Eng.  
 graham.gagnon@dal.ca  
 902.494.3268 F: 902.494.3108



Managing Editor: Monique Doyle  
 Design/Layout: Tabitha Robin  
 Marketing Manager: Darrell Harris  
 Advertising Co-ordinator: Jenna Matthes



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**Magazine Chair:**  
 Julie DiCicco  
 506.633.5000  
 Ext. 5402  
 jdicicco@dillon.ca





## Looking ahead to autumn

Hello readers – thank you for taking the time to enjoy the summer issue of the ACWWA's *Go With the Flow* magazine. I hope you are all having a productive and pleasant summer. Although I really don't want the warm weather to end, it's hard to not look forward to the ACWWA events happening this fall. First of all, I can't wait to take part in the ACWWA Annual Conference in Halifax, from October 6 to 8, 2019. It is gearing up to be a highly educational and entertaining event, and one you won't want to miss. We aim to celebrate and learn from the amazing projects and people involved in the Atlantic Canada water and wastewater industry. Please remember to nominate people and projects for the many awards given out at the conference each year.

ACWWA is hosting the AWWA Regional Meeting of Section Officers from September 6 to 7, also in Halifax. This is an opportunity for representatives from five AWWA Sections in Eastern North America to share ideas and best practices, gain new perspectives, and get updates directly from the AWWA, all in service of improving member experiences. We look forward to hosting this event and putting what we learn to good use.

As I mentioned in a previous post, some of the December Strategic Planning Session was dedicated to initiating an Inclusion, Diversity and Equity (IDE) committee and related policies for the ACWWA. I am pleased to present to you the new ACWWA Policy Statement, shown below, and I hope that you can find it in all future ACWWA

communications. Thanks to the Board members, committee chairs, and to Dallys Serracin-Pitti (IDE Committee Chair) for drafting and adopting this statement, and please feel free to contact me if you have any questions or concerns. On a related note, the ACWWA has partnered with WISEatlantic, the NS Cooperative Education Incentive Program, and the A.D. Foulis Chair in Engineering at Acadia University to study IDE issues within the ACWWA and the Atlantic Canada drinking water industry. We look forward to providing more information soon, and hope that you will be open to participating in the research if requested.

*The Atlantic Canada Water and Wastewater Association strives to create an inclusive, diverse and equitable culture for all members, volunteers and staff. The ACWWA is committed to proactively engaging a workforce of all experience levels and skillsets that reflects the changing demographics of those served by promoting volunteer opportunities that will encourage diversity at the board, committee, and membership levels of the association. The ACWWA understands that its success depends on the full utilization and engagement of all members.*

A reminder that the One AWWA Operator Fund is available to operators and operators-in-training for courses, conferences, books, and other professional development initiatives. You can apply any time on the ACWWA website.

Please feel free to reach out if you have any ideas for the ACWWA ([jennie.rand@acadiu.ca](mailto:jennie.rand@acadiu.ca)). Thank you, and I look forward to seeing you in Halifax! 🌊

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## Attending ACE19

Like many in our Section, I very much looked forward to the AWWA 2019 Annual Conference and Exposition or ACE19. This year ACE19 was hosted by the Rocky Mountain Section in Denver, Colorado. As AWWA is headquartered in the Denver area, you can appreciate that this year's conference was very special.

Each year, I am very fortunate to send a few students who have never attended ACE. This year is no different, as Meaghan and Fatou presented work at ACE. So why would a professor send student researchers to ACE?

- **Mentorship with water professionals.** Mentorship opportunities for YPs and students is an excellent way to learn from experienced individuals that may forever change a career. At an ACE in Boston, one of our Dal students had Jeanne Bennett-Bailey as

a mentor before Jeanne was AWWA President. As many of you know, Jeanne is a thoughtful, driven water leader who shared great advice to our student over a few days. This student is now a consulting engineer in the water industry and currently serves on the ACWWA Board! While I am sure that there are many factors contributing to Julie's success, I am also sure close interaction with Jeanne was long appreciated.

- **Networking with peers.** There are many formal and informal opportunities to connect at ACE. The Canadian Water Forum is an excellent place for students and YPs to see and connect with a broad cross section of the Canadian water community. From bowling to ice vodka to the Canadian Embassy, the venue may change but connection with our peers has been wonderful. For many students this has translated into many different employment opportunities and informal connections.
- **The water industry is on display!** I tell many students to take an afternoon to "walk the floor" – so many opportunities in the water industry are on display on the exposition floor. From water operators to start-up companies and from hydrants to high tech... there is literally something for everyone!
- **Presenting and listening to professional talks.** While it's true that our students will present their work at ACE, and I encourage them to put their best foot forward in presenting – the real reason why we send students is listed above!

"The Canadian Water Forum is an excellent place for students and YPs to see and connect with a broad cross section of the Canadian water community."

When you are thinking of the value proposition to your organization to attending ACE, consider your entire organization – from senior leaders to young professionals; the return on investment can be significant at ACE! 🍷

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## Plan ahead for WEFTEC in Chicago

Summer is finally here... it is time to start planning and registering for WEFTEC.

I am already registered and looking forward to attending this year in Chicago. This is a great opportunity to visit with all the key manufacturers in the water and wastewater industry and connect with many other like-minded individuals. You will find hundreds of opportunities to take in technical presentations and learn about important trends and issues that may affect us all.

You have the opportunity to attend the Canadian Ice Breaker Event at the Rokit Bar and Grill on Sunday, September 22 between 5:00 pm and 9:00 pm. Register at the following link: [www.weao.org/2019\\_weftec\\_canadian\\_icebreaker](http://www.weao.org/2019_weftec_canadian_icebreaker).

Your best rate deadline for WEFTEC is July 12, 2019. Visit [www.weftec.org](http://www.weftec.org) and sign up today.

The Water Environment Federation (WEF) is the not-for-profit organization that brings you WEFTEC.

### WEFTEC 2019

92nd Annual Technical Exhibition and Conference

Conference: September 21–25, 2019

Exhibition: September 23–25, 2019

McCormick Place, Chicago, Illinois USA

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Saturday & Sunday, Sept. 21–22

8:30 am – 5 pm

Monday–Tuesday, September 23–24

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8:30 am – 3:30 pm

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- Stormwater – Treatment, green infrastructure, wet weather management, modeling
- Utility management – Asset Management and financial planning for infrastructure, technology, regulatory compliance, and security; including environmental management systems (EMS)
- Water reuse/recycling – Research, regulations, emerging technologies, proven processes



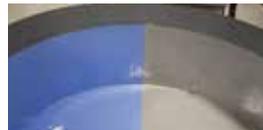
- Water quality & watershed management – Stormwater, wet weather, and watershed issues
- Curtis Smalley, City of Waco, says, “Everyone in the industry needs to attend WEFTEC at least once, but then WEFTEC is like potato chips: You can’t go just once!” Need we say more? 🍌

Source: [www.weftec.org](http://www.weftec.org)

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## CWWA – “The National Voice for Water in Canada”

Greetings to all and I hope you're having and enjoying a great summer. My article will try and provide you with a high-level overview of CWWA activities and provide an update on key initiatives.

There continues to be exciting developments this year with CWWA as the value of working on national initiatives is resulting in positive outcomes. The following will provide an overview of the key subjects being followed and actions being taken by CWWA.

### Health Canada publishes new guidelines for lead (Pb)

Health Canada recently published revised guidelines concerning lead (Pb) in Canadian drinking water. The most significant change is the reduction of the Maximum Allowable Concentration (MAC) of lead in drinking water from 0.01 mg/L to just 0.005 mg/L.

To support water utilities in speaking about these Guidelines to their Council, their customers or the media, CWWA has prepared a Fact Sheet and Speaking Notes. The Fact Sheet provides general details about lead and the guidelines. The Speaking Notes outline key points needed to make as municipal water professionals. CWWA encourages members to use these speaking notes and to share these tools with their communications staff and municipal council. The Fact Sheet and Speaking Notes can be found on the CWWA website at [www.cwwa.ca](http://www.cwwa.ca).

### The federal budget & advocacy

The federal government released its 2019 Budget in early March. There weren't a lot of surprises in there. The

commitment to the environment, to water, and to First Nations continues with significant federal programs for infrastructure and asset management as well as climate change. The biggest news the water sector is an extra \$2.2 billion in the doubling of the Gas Tax Fund for infrastructure. Some utilities may be able to take advantage of funds for skills training, for high-speed internet, or for zero-emission vehicles. More funds are secured through FCM for Climate Change and Asset Management. CWWA continues to work with FCM to promote these programs to our members.

### CWWA Technical Committees and national advocacy

#### Drinking Water Committee

Lead and Manganese Guidelines: In the first week of March, Health Canada published amendments to the National Drinking Water Guidelines to cut the Maximum Allowable Concentration (MAC) of Lead (Pb) in half. The greatest concern is with how this will be rolled out to the provinces and territories and how the public maintains faith in local drinking water. As reported earlier in this article CWWA prepared a Fact Sheet on lead and Speaking Notes to support utilities. These tools are meant to be used when addressing the public and media. These tools are also being distributed to elected officials across Canada by the FCM. The media have just begun to show some interest.

On May 10, 2019, Health Canada published new guidelines for Manganese (Mn) greatly reducing the Aesthetic Objective (AO) to 0.02 mg/L and to set the MAC for the first time at 0.12 mg/L. CWWA is working on

a Fact Sheet and Speaking Notes for manganese.

#### Water Efficiency Committee

This committee is reorganizing its structure and goals. A few years ago, the Energy Committee was merged with this Water Efficiency Committee to focus on the 'nexus' of water and energy. After a few very productive years, the committee is refocusing on the water efficiency side while the energy team is realigning itself with the Climate Change Committee. The committee's most recent reports and positions papers on pump efficiency, high water users, and food waste grinders are all available on the CWWA website.

#### Wastewater Committee

Updates around the Wastewater Systems Effluent Regulations (WSER) will be presented at the Window on Ottawa in June, but there is very little federal activity here. CWWA was recently consulted by the Ecosystems Management Directorate at DFO on their work on species at risk.

CWWA continues its partnership with MESUG (Municipal Enforcement Sewer Use Group) to develop an international coalition of the wastewater sector to develop an international position statement. The group is known as the International Water Services Flushability Group (IWSFG). In its effort with MESUG to develop a Canadian Standard that can eventually be enforced, CWWA has established a national project fund to support research.

#### Climate Change

CWWA holds a seat on the Advisory Council for the National Roundtable on Flood Risk. Two national working

groups have been established. One is the Financial Working Group, led by the Insurance Bureau of Canada that is looking at the issues of risk, insurance, and assistance funding. The other is the Flood Mapping Working Group, led by Natural Resources Canada. CWWA is represented on both of these working groups as well as coordinating dialogue with its municipal partners at FCM and CWN.

### Utility Leadership

The committee released a Position Statement on Sustainable Utility Management and is working on supplemental positions.

### Other CWWA collaborations

CWWA continues to facilitate cooperation amongst many national water organizations such as the Canadian Water Network, Canadian Association for Water Quality, Canadian Public Works Association, Canadian Water Resources Association, Canadian Network of Asset Managers, Public Sector Digest, the Federation of Canadian Municipalities and more. As CWWA addresses federal legislation and policies, CWWA also works to strengthen the collective voice from this municipal water sector.

Summer continues to be a busy time for the CWWA staff as they finalize the details for the National Water & Wastewater Conference (NWWC) scheduled for Banff, Alberta in November.

**Please mark your calendars:  
National Water Wastewater  
Conference – 2019  
November 3 to 6  
Fairmont Banff Springs Hotel,  
Banff, Alberta**

Should any other information be required on CWWA activities or initiatives, please do not hesitate to contact me directly at [roland.richard@nb.sympatico.ca](mailto:roland.richard@nb.sympatico.ca) or visit the CWWA website at [www.cwwa.ca](http://www.cwwa.ca). 

“Summer continues to be a busy time for the CWWA staff as they finalize the details for the National Water & Wastewater Conference.”



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## Acknowledging one of our long-term members

Many of us have been ACWWA members for a very long time, some even for our entire careers. However, only a few of us can say that we have been a member for 50 years!

ACWWA member Daryl McLennan joined AWWA in January 1969. Daryl was born on April 27, 1938. He began his career in the industry in December 1957 with T. McAvity & Sons in Saint John, NB. His departure in 1969 was due to him opening his new business, McLennan Sales. In 1988, Daryl sold McLennan Sales



to Emco Corporation, where he continued to work with the company as a manager across Canada until 2006. After 2006, he worked more locally on requisitions until December 2018 when he decided to officially retire. Daryl has admitted it is very difficult to step back from the industry he was devoted to for so long.

Daryl has been involved with ACWWA in several volunteer positions. He has supported ACWWA tremendously through the years with both his volunteering as well as his various generous donations. When asked what he thought was the most important value of being a member of ACWWA, he did not hesitate to say “networking.” He then said, “Waterworks people are the nicest people in the world.”

Congratulations, Daryl, on your retirement! ACWWA will miss seeing you at our events!

### Refer a member contest

Do you want a chance to win \$50 gift card of your choice? You can do so by referring a new member. Quarterly draw are done with winners appearing in the magazine. No winners this month. 🍀



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### Welcome to our new members

Name	Company	Membership
Dawn Chaplin	Town of Torbay	AWWA
MaryAnn Comeau		AWWA
Dave McKenna	Dillon Consulting Limited	AWWA
Wally Morrissey	Village of Riverside – Albert Water	AWWA
Sharon Rhynold	G&R Kelly	AWWA
Stanley Walker	Town of Middleton	AWWA
Lisa Langille	Municipality of Kings County	AWWA
Hoda Tafvizi	Memorial University	AWWA/WEF
Shams Anwar	Memorial University	AWWA/WEF
Chrissy Duggan	Dalhousie University	AWWA/WEF
Jacob Power	Université de Moncton	AWWA/WEF
Karlee MacDonald	Holland College	AWWA/WEF
Ethan Taweel	Holland College	AWWA/WEF
Brenda Mackinnon		AWWA
Lise LeBlanc	LP Consulting	WEF
Amber Ferguson	Sansom Equipment	WEF

### As of May 21, 2019 :

Total AWWA active members: **426**  
 Total AWWA late members: **26**  
 Total WEF active members: **106**  
 Total WEF late members: **24**

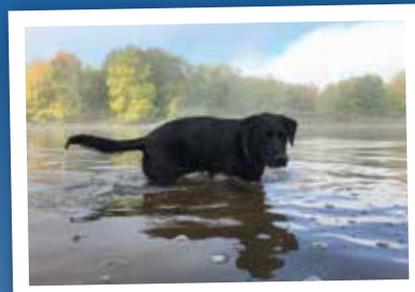
## 2019 ACWWA PHOTO CONTEST Our Family\* and Water (\*includes pets)



1<sup>ST</sup> Runner Up: Noah Brace  
(student)



2018 Top Prize: Shawn Burke  
(Crandall Engineering)



2<sup>ND</sup> Runner Up : David Parsons (CBCL)

TOP PRIZE – \$250 gift card of your choice  
SECOND PLACE PRIZE – \$150 gift card of your choice  
THIRD PLACE PRIZE – \$100 gift card of your choice

#### Rules and Criteria:

1. Photo must be submitted by an ACWWA member.
2. Photo must include water AND a family member(s) and/or pet(s).
3. Please provide first name of those in photo.
4. Unlimited submissions. Only one winning picture per member.
5. Judged by ACWWA Board.
6. Deadline for submission is September 1, 2019.
7. Submit pictures or questions to [julie.stokes@moncton.ca](mailto:julie.stokes@moncton.ca).

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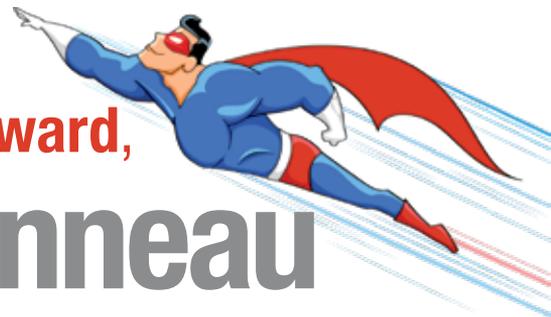
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# Winner of the **Silent Hero Award**, **Christian Vienneau**



1. **Job title:** Senior Water and Sewer Operator.
2. **Who do you work for?** City of Dieppe.
3. **Where do you currently live?** Shediac.
4. **Where did you grow up?** Shediac.
5. **When I'm not working, I...** Spend time with my wife and two kids, and in my spare time I race small sailboats and teach karate.
6. **What is your philosophy on life?** Don't put off 'til tomorrow the fun you can have today!
7. **Toughest thing about your job?** When on-call you miss so many events like a kid's dance competition, or a sailboat race. Not being able to fully commit because for that time being you have to be able to respond to an emergency is tough, but someone has to do it.
8. **When you were a kid, what did you want to be when you grew up?** Musician – I wanted to play in a band and travel the world.

9. **Last book you read?** Young Lions (an epic story about perseverance and never giving up!) A life story by Judd Reid.
10. **What music did you listen to this morning?** "Georgia on my mind" (by Cory Tetford & Kendel Carson).
11. **Favourite TV show?** Game of Thrones.
12. **Not many people know that I...** Have built my own acoustic guitar from scratch.
13. **What is your greatest luxury?** My sailboat. It's quite inexpensive but after only a few minutes of sailing I feel like my mind is at peace.
14. **Describe your perfect day.** Wake up, practice karate for one hour, help out my kids in whatever they need, sail for a few hours, followed by a good house party with a few close friends and family.
15. **What three objects would you rescue from your burning house?** Kids' trophies and family photos, hard drive, and guitar.



16. **What AWWA/WEF Section would you most like to visit, and why?** Probably WEF since I have already been to AWWA and I would love to see the differences.
17. **Who is the most influential person in your life?** My father. So much of what I know and my trouble-shooting knowledge can be traced back to my father showing me how things worked.
18. **What is your ideal vehicle?** Tesla. 🚗



## THE PANEL SHOP

For further information please contact:

Mr. Michael Hickey  
Branch Manager, The Panel Shop  
506-455-1925 , Michael.Hickey@Pennecon.com

Mr. Mark Whalen  
Controls & Automation Manager, Pennecon  
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## The ABEA has something for you!

The ABEA continues to bring added value to the ACWWA with its many initiatives.

We would like to congratulate



Kyle Brewer, son of Trent Brewer – City of Fredericton, on being awarded an ABEA Academic Scholarship. Kyle will be attending UNB this fall, with his eye on a

future position in Utility Management. We wish him all the best!

ABEA/ACWWA Annual Attendance GRANT applications are being accepted (visit [www.ABEA.biz](http://www.ABEA.biz) for the full application).

We look forward to hosting qualifying individual(s) at the 2019 ACWWA Conference, to be held in Halifax, Nova Scotia, October 6 to 8.

The ABEA is preparing for the Annual Golf Tournament to be held at Lost Creek, Beaverbank ([www.lostcreek.ca](http://www.lostcreek.ca)) on Sunday, October 6 starting at 10:00 am, shotgun format. Your \$75 fee will cover green fees and a shared cart –

don't forget to register early, and if you have a team or playing mate, please contact Cathy Cameron ([scotiatche.main@ns.sympatico.ca](mailto:scotiatche.main@ns.sympatico.ca)). Transportation will be provided by the Conference Committee.



As we get closer to this year's ACWWA Annual Conference in Halifax, we are completing last-minute preparations for the ever-popular ABEA Common Hospitality Event to be held on Monday evening in The Schooner Room at Casino Nova Scotia. The sounds of Monkey's

Uncle will keep the mood bubbly and jovial, with lighter fare being served to accompany the suds.



Tuesday morning will allow our Monday evening ABEA Host Suppliers the opportunity to share their industry knowledge and latest offerings at the Annual Tradeshow – we look forward to seeing you there!

This year we will be hosting a “hands-on demonstration” during the Trade Show – beginning at 12:30 pm. 



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# A MESSAGE FROM THE CONFERENCE CO-CHAIRS



WENDY KRKOSEK, PH.D., P.ENG.

On behalf of the Conference Organizing Committee, we are excited to extend an invitation to you to attend the 72nd Annual Conference of the Atlantic Canada Water and Wastewater Association in Halifax, Nova Scotia from October 6 to 8, 2019 at the Marriott Harbourfront Hotel.

The theme of this year's conference is *Uncharted Waters: Preparing for the Unknown*. Water and wastewater utilities are facing an ever-increasing list of challenges including climate change, failing infrastructure, new regulations, and changing technology. Utilities need to try their best to be prepared so that they can successfully navigate these challenges. The conference committee has put together a conference program that ties into this theme.

Our keynote address will be given by Carl Yates, P.Eng. Carl will be retiring as the General Manager from Halifax Water at the end of June 2019 after more than 30 years of service to the water and wastewater industry in Atlantic Canada and beyond. We are looking forward to hearing Carl's insight on the industry.

Our Technical Program will be comprised of many great papers representing a diverse cross-section of the water and wastewater industry. New this year is an early bird theme on Tuesday before the trade show. Based on your feedback, we've also added some non-technical talks this year. From the Keynote Address to *The Leadership Lineup* stream, come and learn from both seasoned and emerging leaders in the water industry.



JOHN EIGNOR, M.A.S.C., P.ENG.

On Monday night, we continue the tradition of Dine on Your Own. This will be the perfect opportunity to connect with fellow delegates in a non-formal setting and experience the fine dining that Halifax has to offer. Then finish off the evening at the ABEA Hospitality event at the Schooner Room of Casino Nova Scotia, where you can kick up your heels with some local entertainment.

Once again, the ABEA Trade Show will be a great event to see the latest products and speak with suppliers. Make sure you get there early to see the "Best of the Best" Tap Water Taste Test competition. The conference will wrap up Tuesday night with the Down East Feast and the mystifying acrobatics of Atlantic Cirque.

Come early or stay late so that you take the time to get out and enjoy downtown Halifax. There is always something fun and exciting happening in the harbor city. We can't wait to see you in Halifax this fall.

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## UNCHARTED WATERS KEYNOTE ADDRESS



CARL YATES, M.A.SC., P.ENG.

Carl Yates has extensive experience in the water utility profession having served as Project Engineer, Chief Engineer and General Manager of the Halifax Water Commission from 1988 to 1996. In 1996, he was appointed General Manager of the Halifax Regional Water Commission, which assumed a regional mandate after the municipal amalgamation of the greater Halifax area in 1996. In 2007, Mr. Yates oversaw the

formation of the first regulated water, wastewater, and stormwater utility in Canada with the transfer of wastewater and stormwater assets from the Halifax Regional Municipality. Halifax Water is a body corporate municipal utility, generating approximately 140 million dollars in annual revenue with assets of over \$2 billion.

Mr. Yates obtained a Bachelor of Engineering from Memorial University of Newfoundland in 1984 and a Master of Applied Science from the Technical University of Nova Scotia [now Dalhousie University] in 1992. He is Past Chair of the Focus Area Council of the Water Research Foundation, Vice Chair of the Canadian Water Network, Board Director of the Alliance for Water Efficiency, and a past member of the Board of Directors of Special Olympics Nova Scotia.

## AWWA REPRESENTATIVE



THERESA O'GRADY  
VICE-PRESIDENT (2018-2020)  
AMERICAN WATER WORKS ASSOCIATION

Theresa is the Water Resources Group Manager for Crawford, Murphy & Tilly, Inc in Aurora, Illinois. With 24 years of experience in the water industry, Theresa has been an active member of AWWA since 1996.

Involved in the Illinois Section, Theresa has served two terms as Trustee – District 2, Vice-Chair, Chair-Elect, Chair and Past-Chair. On the Association

level, she is serving on the Board of Directors as the Illinois Director and Vice President. She is also a member of the AWWA Engineering and Modeling Applications Committee (EMAC). She is also a member of Mid-Central Waterworks Association and Kane County Water Association. Currently, she is serving as the Resident Representative on the Will County Stormwater Planning Committee.

Theresa holds a BS degree in Civil Engineering with a Hydraulics & Hydrology Emphasis from the University of Illinois, Champaign-Urbana and is a licensed Professional Engineer (P.E.) in the State of Illinois. She lives in Naperville, Illinois with her husband and two children.

## CWWA REPRESENTATIVE



ROBERT HALLER

Robert Haller is the executive director of the Canadian Water and Wastewater Association, a role he took on after almost 20 years as a senior municipal administrator – most of those years serving as a CAO for small and medium-sized communities. He claims to be a geographer first, with a BA from Carleton University,

followed by a Master's in Public Administration from the University of Western Ontario.

Robert leads the CWWA as THE national voice for municipal water and wastewater and promotes collaboration between all the water organizations across Canada. Robert represents the municipal water sector to the federal government on issues such as infrastructure funding, flood risk, security, drinking water guidelines and more. He works closely with all the water associations in North America on education, communications, and utility leadership and represents Canada to the International Water Association.

## WEF REPRESENTATIVE



THOMAS E. KUNETZ, P.E.

Thomas E. Kunetz is the 2018–2019 President of the Water Environment Federation (WEF), an international organization of water quality professionals headquartered in Alexandria, VA.

Tom is the assistant director of monitoring and research for the Metropolitan Water Reclamation District of Greater Chicago, leading the district's efforts on key strategic engineering initiatives. He has more than 30 years of experience in the field of environmental engineering in both the public and private sectors, focusing on design of wastewater

treatment facilities, improving the water environment, and protection of public health.

A WEF member since 1992, Tom is the past chair of the Municipal Wastewater Treatment Symposium, and served on the Program Committee, and the Municipal Water Resource Recovery Design Committee. He was a member of the Chicago WEFMAX organizing committee, and served on the Stockholm Junior Water Prize organizing committee with the Illinois Water Environment Association.

Tom is a registered professional engineer in the state of Illinois. He is a graduate of the WEF-sponsored Water and Wastewater Leadership Center at the University of North Carolina, the 2012 recipient of the Charles Walter Nichols Award for Environmental Excellence from the American Public Works Association, and a WEF Fellow. Tom earned his B.S. in environmental engineering from the Pennsylvania State University and an M.S. in water resources engineering from Villanova University.

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# CONFERENCE HIGHLIGHTS

<b>10.06.2019</b> SUNDAY	<p>10.00 AM</p> <p>1.00 PM - 4.00 PM</p> <p>1.00 PM - 3.30 PM</p> <p>5.00 PM - 7.00 PM</p> <p>7.30 PM - 10.30 PM</p> <p>8.30 PM - 9.30 PM</p>	<p>ABEA Golf Tournament at Lost Creek Golf Club &amp; Village</p> <p>Young Professionals Event</p> <p>Technical Tour of Lake Major Dam</p> <p>Young Professionals Meet &amp; Greet, The Lower Deck (2<sup>nd</sup> Floor)</p> <p>Meet &amp; Greet Reception, Sable Ballroom</p> <p>Water Tower Competition, Sable Ballroom</p>
<b>10.07.2019</b> MONDAY	<p>7.30 AM - 8.30 AM</p> <p>8.30 AM - 10.00 AM</p> <p>10.30 AM - 12.00 PM</p> <p>12.00 PM - 1.30 PM</p> <p>1.30 PM - 4.45 PM</p> <p>5.00 PM - 6.00 PM</p> <p>6.00 PM - 8.00 PM</p> <p>9.00 PM - 1.00 AM</p>	<p>Continental Breakfast</p> <p>Opening General Session, Nova Scotia Rooms A &amp; B</p> <p>Technical Sessions, Halifax Rooms A, B &amp; C</p> <p>ACWWA AGM &amp; Awards Luncheon, Nova Scotia Rooms C &amp; D</p> <p>Technical Sessions, Halifax Rooms A, B &amp; C</p> <p>Water for People 5K Fun Run/Walk</p> <p>Dine On Your Own - Explore Downtown Halifax</p> <p>ABEA Common Hospitality Reception, Schooner Room, Casino NS</p>
<b>10.08.2019</b> TUESDAY	<p>7.30 AM - 8.30 AM</p> <p>8.00 AM - 9.30 AM</p> <p>9.30 AM - 10.30 AM</p> <p>10.00 AM - 2.00 PM</p> <p>2.00 PM - 4.00 PM</p> <p>6.30 PM</p>	<p>Continental Breakfast</p> <p>Technical Sessions, Halifax Rooms A, B &amp; C</p> <p>“Best of the Best” Tap Water Taste Test</p> <p>ACWWA/ABEA Tradeshow, Nova Scotia Ballroom</p> <p>Technical Sessions, Halifax Rooms A, B &amp; C</p> <p>Down East Feast, Nova Scotia Ballroom</p>

## 2019 ABEA ANNUAL GOLF TOURNAMENT

We welcome you to join us for our Annual Golf Event being held at 10:00 AM on October 6, 2019 – sponsored by the ABEA, and its individual members.

### LOST CREEK GOLF CLUB AND VILLAGE

**\$75+ tax**

Includes: Green fees, shared cart & range balls  
*Transportation & lunch will be provided.*

## YOUNG PROFESSIONALS SEMINAR

The Young Professionals Committee is inviting conference attendees to sign up for the YP Seminar, which is being held from 1:00 PM to 4:00 PM on the opening day of the conference, Sunday, October 6.

This year, the seminar is themed “How to navigate your social and professional network” and will feature presentations on topics such as professional development using social media, entrepreneurship and startups, and maintaining a work/life balance.

## 12TH ANNUAL ABEA COMMON HOSPITALITY RECEPTION

The Atlantic Branch Equipment Association cordially invites all ACWWA Conference delegates and attending members to join us for an evening of music, mingling, and munchies at Casino NS – Schooner Room, on Monday October 7, 2019.

Festivities run from 9:00 PM – 1:00 AM, with music supplied by Monkey’s Uncle – a local favourite. Check out Monkey’s Uncle on Facebook and Twitter: @monkeysunclhfx

## 2019 ACWWA & ABEA TRADE SHOW

The 2019 Trade Show will be held Tuesday morning, October 8, 2019, beginning at 10:00 AM, offering 80 booths.

### HANDS-ON TECHNICAL DEMO

#### Safe and Efficient Measures When Hot Tapping Pressurized Watermains – Large Diameter 12:30 PM

ABEA Trade Show space (Nova Scotia Ballroom)  
Presented by Mueller and the City of Charlottetown.

## TECHNICAL TOUR: THE NEW LAKE MAJOR DAM



The existing Lake Major Dam is a rock-filled timber crib structure which was originally built for a private milling operation in the 1940s. In 2012, as part of Halifax Water’s Dam Safety Program, a study concluded that the Lake Major Dam needed to be replaced due to its age and location.

Starting in 2014, Halifax Water began the concept design and environmental approvals process in to complete the replacement project. Construction approval from the regulatory bodies was received in May 2018 with construction starting early June 2018.

The new dam is a concrete structure, complete with a labyrinth spillway, adjustable weir fish ladder, and two low-level sluice gates.

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# TECHNICAL PROGRAM

10.07.2019 MONDAY		10:30 AM - 11:15 AM	11:15 AM - 12:00 PM		
<b>A1</b> Technical Session <b>Halifax Room A</b>	<b>Championing Change on the LaHave River</b>  Stella Bowles Stella Bowles prompted action for the clean up of Nova Scotia's LaHave River, which contains alarmingly high levels of fecal contamination. Because of her work, three levels of government have allocated \$15.7 million dollars to address the problem of illegal straight pipes that still drain raw sewage from over 600 homes along the river. Three years since her initial research, Stella continues to be an advocate for the elimination of illegal straight pipes province wide.		<b>The Benefits of Effective Leadership and Leadership Training</b>  Tabatha Thibault, Saint Mary's University Tabatha Thibault holds a MSc in Applied Psychology focusing on Industrial/Organizational Psychology. She is currently a PhD candidate in Industrial/Organizational Psychology at Saint Mary's University as well as a part-time professor. Her research interests include leadership development, the Dark Tetrad of personality, and incivility and cyber deviance in the workplace. She has been part of a research-practitioner team that conducts leadership training workshops for the past three years.		
	<b>Hydraulics of Pressure Sewer Systems</b>  Keith McHale Environment One Corporation		<b>Wet Weather Flow Management for Trunk Sewer Systems - City of Toronto Black Creek Sanitary Servicing Study</b>  Stewart Dickson & Harshad Shetye WSP Canada		
	<b>Aerotech Wastewater Treatment Plant Expansion and Upgrade</b>  Daryl Burke, EXP Services Inc.		<b>Ammonia Limits and Lagoons: Atlantic Canada's Options for Beating Effluent Limits</b>  Francis Bordeleau Nexom		
		1:30 PM - 2:00 PM	2:00 PM - 2:30 PM	2:30 PM - 3:00 PM	
<b>B1</b> Technical Session <b>Halifax Room A</b>	<b>Harvesting Nutrients for Reuse from Municipal Wastewater Using a Revolving Algae Biofilm System</b>  Tom Kunetz MWRD Chicago	<b>The Use of Rare Earth Metals for Targeted Removals of Phosphorus</b>  Kevin Bossy Bishop Water Technologies	<b>The Hidden Value in Wastewater</b>  Lili Torres Inland Technologies 		
	<b>PFAS Dark Matter: Precursors in Soil and Water</b>  Virgil Guran Maxxam Analytics	<b>Ellenvale Run Watercourse Rehabilitation</b>  Adam Sketchly & Evan Teasdale DesignPoint Engineering and Surveying	<b>Potential Corrosivity of Groundwater in Nova Scotia and its Association with Lead in Private Well Water</b>  Gavin Kennedy NS Department of Energy and Mines		
	<b>Assessing Recoverable Leakage Potential Through Evidence-Based Performance Indicators</b>  Fabian Papa & Bradley Jenks HydraTek & Associates	<b>Water Loss Reduction Through Pressure Management to Save Money</b>  Jody Malo Omnitech Inc.	<b>Water Distribution Monitoring to Inform Non-Revenue Water Reduction</b>  Zachary Barker Visenti, A Xylem Brand		
		3:15 PM - 3:45 PM	3:45 PM - 4:15 PM	4:15 PM - 4:45 PM	
<b>C1</b> Technical Session <b>Halifax Room A</b>	<b>Lake Recovery Through Reduced Atmospheric Deposition: Experiences in Atlantic Canada and Key Lessons Learned</b>  Lindsay Anderson Dalhousie University	<b>Operational Challenges at JD Kline Water Supply Plant in Light of Lake Recovery</b>  Sanjeev Tagra Dalhousie University & Halifax Water	<b>Decision Making in an Era of Changing Source Water</b>  Wendy Krkosek Halifax Water		
	<b>PVC Watermain Pipe - 40 Years of Successful Service</b>  Douglas Seargeant IPEX	<b>Saving Energy and Money Through Better Wastewater Treatment Plant Mixing</b>  Michele Braas Xylem Inc.	<b>Operational Improvements for Small and Medium-Sized Utilities</b>  Darren Row & Jay Shanahan City of Miramichi		
	<b>Repair of a Critical Transmission Main</b>  Kevin Healy Halifax Water	<b>Twin Rivers Effluent Pipe Replacement</b>  Garrett Proud Stantec Consulting Ltd	<b>Minimize Metal and Concrete Damage in Water and Wastewater Applications</b>  Randy Nixon Corrosion Probe Inc.		

HANDS-ON TECHNICAL DEMO: SAFE AND EFFICIENT MEASURES WHEN HOT TAPPING PRESSURIZED WATERMAINS - LARGE DIAMETER

TUESDAY, OCTOBER 8, 12:30 PM

ABEA TRADESHOW SPACE (NOVA SCOTIA BALLROOM) PRESENTED BY MUELLER AND THE CITY OF CHARLOTTETOWN

10.08.2019 TUESDAY	8:00 AM - 8:30 AM	8:30 AM - 9:00 AM	9:00 AM - 9:30 AM	
<b>D1</b> Technical Session Halifax Room A	<b>Planning for the Unknown Future and Reshaping Saint John's Water System</b>  Dean Price Saint John Water	<b>Buffalo NY: Achieving 21<sup>st</sup> Century Results with Legacy Infrastructure</b>  Tim Braun Emnet, A Xylem Brand	<b>Small Utility Tackles Full Water Meter Conversion to New Meters, New Technology, and Changing from Imperial to Metric</b>  Jesse Hulsman Municipality of East Hants	
<b>D2</b> Technical Session Halifax Room B	<b>Pilot Plant Optimization Study of Coagulation Processes in a Direct Filtration Plant for Source Water Undergoing Lake Recovery</b>  Isobel DeMont Dalhousie University 	<b>Testing Ultraviolet Light Emitting Diodes (UV LEDs) Apparatus for Point-Of-Use (POU) Drinking Water Disinfection</b>  Carolina Ontiveras Dalhousie University	<b>Understanding Drinking Water Biofiltration: Monitoring and Optimization Approach</b>  Leili Abkar & Anita Taylor Dalhousie University 	
<b>D3</b> Technical Session Halifax Room C	<b>MBBR Treatment in Saint John, NB</b>  Alexander Williams Dillon Consulting	<b>Understanding the Impacts of Domestic Wastewater Microbial Communities on Rapid ATP-Based Monitoring Techniques for UV Inactivation</b>  Kyle Rauch Dalhousie University 	<b>EISI Upgrades Wastewater Treatment Plant at Atlantic Beef Products to First Membrane Bioreactor in Prince Edward Island</b>  Adam Ryder ADI Systems	
	2:00 PM - 2:30 PM	2:30 PM - 3:00 PM	3:00 PM - 3:30 PM	3:30 PM - 4:00 PM
<b>E1</b> Technical Session Halifax Room A	<b>Update on Health Canada's Guidelines for Canadian Drinking Water Quality for Aluminum and Natural Organic Matter</b>  Judy MacDonald Health Canada	<b>Kankakee Water Treatment Plant Improvements</b>  Theresa O'Grady Crawford, Murray & Tilley	<b>Updates and Incorporation of Climate Change into the Atlantic Canadian Water and Wastewater Design Guidelines</b>  Willard D'Eon CBCL Ltd.	<b>Gas Monitoring Requirements, Assessments and Certification</b>  Amyr Bhimani Hetek Solutions
<b>E2</b> Technical Session Halifax Room B	<b>Putting All the Pieces Together: More Than Just Another All-Pipe Wastewater Model Build</b>  David Blades Halifax Water	<b>Use of CFD Analysis for Secondary Clarifier Design</b>  Mike Abbott CBCL Ltd.	<b>A Proactive Approach to Transmission Main Condition Assessment - St. John's Regional Water Supply</b>  Clayton MacDougald Pure Technologies, a Xylem Brand	<b>Confirming Uncertain Ground Conditions by Analyzing Microtunnel Data</b>  Troy Bauman Robinson Consultants
<b>E3</b> Technical Session Halifax Room C	<b>The Importance of Quality Control for CIPP Rehabilitation of Sewers</b>  Kevin Bainbridge Robinson Consultants	<b>CIPP Watermain Lining - Consolidated Design and Compliance Guidance and Technical Advances</b>  George Bontus Aegion Corporation	<b>Large Diameter Watermain Lining in the City of Toronto</b>  Stewart Dickson & Patrick Lewis WSP Canada	<b>Storm Water Management: Underground Storm Sewer Treatment Unit and Canadian ETV Protocol Using Hydrodynamic Separation</b>  Philippe Losier Soleno

 Fresh Ideas presenters are a first time Young Professional participant at the ACWWA section conference presenting a water related topic, and will be considered for the Fresh Ideas program that has been developed through AWWA's Manufacturers/ Associates Council and the Young Professionals Committee. The top presentation selected from this group of presenters will be given the opportunity to compete in the Fresh Ideas poster competition at the AWWA Annual Conference and Exposition (ACE 2020) in Orlando, FL, representing the Young Professionals of ACWWA. Along with complimentary conference registration provided by the ACE 2020 organizing committee, ACWWA will provide the winner with a stipend to assist with travel costs to the conference.

### ACWWA Conference Registration

PART 1 – CONFERENCE ATTENDEE GENERAL INFORMATION					
FIRST NAME		LAST NAME		ORGANIZATION	
MAILING ADDRESS				CITY	
PROVINCE	COUNTRY	POSTAL CODE		AWWA MEMBERSHIP NUMBER	
PHONE		FAX		WEF MEMBERSHIP NUMBER	
REGISTERED COMPANION/SPOUSE			EMAIL ADDRESS		
Check box if you would like to be added to the ACWWA email list <input type="checkbox"/> Check box if you are a first time conference attendee <input type="checkbox"/>					
Sector <input type="checkbox"/> Utility <input type="checkbox"/> Supplier <input type="checkbox"/> Contractor <input type="checkbox"/> Consultant <input type="checkbox"/> Student <input type="checkbox"/> Academic <input type="checkbox"/> Regulator <input type="checkbox"/> Other					

PART 2A – DELEGATE REGISTRATION			
Full Conference Delegate – On or Before Sept 6, 2019 - Includes all Meals	<input type="checkbox"/> Member – \$475	<input type="checkbox"/> Non-Member – \$525	\$
Full Conference Delegate – After Sept 6, 2019 - Includes all Meals	<input type="checkbox"/> Member – \$575	<input type="checkbox"/> Non-Member – \$625	\$
Companion/Spouse Program – Includes all Meals	<input type="checkbox"/> Member/Non-Member – \$275		\$
Student (Includes Meet & Greet, Breakfasts/Lunches, ABEA Reception and Trade Show) Registration is free if the student is presenting a technical session	<input type="checkbox"/> Member/Non-Member – \$50		\$
Monday Full Day Pass (Includes Breakfast, AGM Lunch and ABEA Hospitality Reception)	<input type="checkbox"/> Member – \$250	<input type="checkbox"/> Non-Member – \$275	\$
Tuesday Full Day Pass (Includes Breakfast, Trade Show & Lunch, and Down East Feast)	<input type="checkbox"/> Member – \$250	<input type="checkbox"/> Non-Member – \$275	\$
Tuesday 1/2 Day Trade Show Pass (Includes Breakfast, Trade Show & Lunch)	<input type="checkbox"/> Member – \$125	<input type="checkbox"/> Non-Member – \$150	\$
<b>Register before August 15, 2019 and be entered for the early bird draw</b>			<b>Part 2 – Subtotal</b> \$

PART 2B - DELEGATE MEALS & ACTIVITIES NOT INCLUDED WITH REGISTRATION			
<b>Sunday, October 6</b>		<b>Please indicate attendance by checking box</b>	
Golf – Transportation, Green Fees, Shared Cart and Lunch Included Indicate your shirt sizes: SM____, MED____, LG____, XL____, XXL____		___ @ \$75 =	\$
Tour of Lake Major Dam (Hard hat, safety vest, and steel toe work boots required)		___ @ \$15 =	\$
Young Professional Workshop – Registration is free – Please indicate if you are attending		Yes	No
<b>Tuesday, October 8</b>			
Down East Feast – <b>Included in Delegate/Companion</b> Registration Fees	Additional Tickets ___ @ \$75		\$
Please indicate meal choice for Down East Feast for Delegate/Companion	Salmon ___	Chicken ___	Beef ___
Please describe any dietary restrictions or other special needs you may have			<b>Part 2 – Subtotal</b> \$

PART 3A – TRADE SHOW BOOTH RENTAL & EXHIBITOR REGISTRATION			
Booth Rental (Max 3 Booths & 2 People/Booth)	ABEA Member – ___ Booths @ \$525	Non-Member – ___ Booths @ \$900	\$
EXHIBITOR'S NAME	EXHIBITOR'S NAME	EXHIBITOR'S NAME	
EXHIBITOR'S NAME	EXHIBITOR'S NAME	EXHIBITOR'S NAME	
Extra Booth Exhibitor Registration (includes Meet & Greet, ABEA Hospitality Reception, Trade Show Lunch)	ABEA Member – ___ @ \$75	Non-Member – ___ @ \$100	\$
EXHIBITOR'S NAME	EXHIBITOR'S NAME	EXHIBITOR'S NAME	
			<b>Part 3 – Subtotal</b> \$

PART 3B - EXHIBITOR MEALS & ACTIVITIES NOT INCLUDED WITH REGISTRATION			
<b>Sunday, October 6</b>			
Golf – Transportation, Green Fees, Shared Cart and Lunch Included Included Indicate your shirt sizes: SM____, MED____, LG____, XL____, XXL____		___ @ \$75 =	\$
Tour of Lake Major Dam (Hard hat, safety vest, and steel toe work boots required)		___ @ \$15 =	\$

<b>Exhibitor Booth registration <u>does not</u> include the full conference or meals. To attend full conference, register as a Delegate in Part 2</b>		
<b>Monday, October 7</b>		
Pick-Up Breakfast	Exhibitor ___ @ \$34	\$
Annual General Meeting Luncheon	Exhibitor ___ @ \$46	\$
<b>Tuesday, October 8</b>		
Pick-Up Breakfast	Exhibitor ___ @ \$34	\$
Down East Feast	Exhibitor ___ @ \$75	\$
Please indicate meal choice for Down East Feast	Salmon ___	Chicken ___ Beef ___
Please describe any dietary restrictions or other special needs you may have	<b>Part 3 – Subtotal</b>	
		\$

<b>PART 5 – FEES</b>	
<b>Subtotal</b>	\$
Life Members deduct \$100.00	\$
<b>HST 15% (869 924 910 RT2)</b>	\$
Indicate your shirt size(s): SM___, MED___, LG___, XL___, XXL___	Water for People Fun Run ___ @ \$25.00 Water for People Fun Walk ___ @ \$25.00
	\$
	\$
<b>Total Amount Due</b>	\$

<b>PART 6 - PAYMENT OPTIONS</b>	
Choose payment method. Complete as appropriate.	
<input type="checkbox"/> Cheque	<input type="checkbox"/> Money Order
<input type="checkbox"/> Visa	<input type="checkbox"/> MasterCard
Please make cheque or money order payable to "ACWWA Conference", Box 28142, Dartmouth, NS B2W 6E2	
CARD HOLDER NAME	
CARD NUMBER	EXPIRY
SIGNATURE	
Fax: 902-435-7796 or Email: <a href="mailto:contact@acwwa.ca">contact@acwwa.ca</a>	EMAIL ADDRESS
<b>WHEN PAYING WITH A CREDIT CARD AN EMAIL ADDRESS IS REQUIRED FOR A RECEIPT TO BE ISSUED</b> By registering for this event, your contact information may be shared with exhibitors and/or sponsors.	

**Conference Information**  
Full conference has a 1.5 CEU value.

**Trade Show Information**  
Each booth measures 8' x 8'. Booth selection will be online and first come first serve. ABEA members will have exclusive access for one week prior to general public. Contact the ABEA to learn more about becoming an ABEA member (Cathy Cameron at [scotiatech.main@ns.sympatico.ca](mailto:scotiatech.main@ns.sympatico.ca)). For trade show questions contact Cathy Cameron at [scotiatech.main@ns.sympatico.ca](mailto:scotiatech.main@ns.sympatico.ca).

\*\*\*Booth registrations **must be paid** with Visa or MasterCard **at time of booth selection in order to confirm registration**\*\*\*

**ACWWA Delegate Cancellation Policy**  
Cancellations must be received in writing, on company letterhead, and faxed, mailed or emailed to the ACWWA Office. Phone cancellations are not accepted. All cancellations postmarked/fax-dated 14 days in advance of the conference start date will receive a full refund, minus a 10% administrative fee. Cancellations between 7 and 14 days of the conference start will receive a 50% refund. Cancellations less than 7 days in advance of conference will not be refunded. Please note that substitute registrants are welcome. Fax requests for substitutions or cancellations to (902) 435-7796 or email to [contact@acwwa.ca](mailto:contact@acwwa.ca).

**ACWWA Trade Show Cancellation Policy – Payment Options**  
Cancellations must be received in writing, on company letterhead, and faxed, mailed or emailed to the ACWWA Office. Phone cancellations are not accepted. All cancellations postmarked/fax-dated 30 days in advance of the conference start date will receive a 50% refund. Cancellations less than 30 days in advance of conference will not be refunded. Please note that substitute registrants are welcome. Fax requests for substitutions or cancellations to (902) 435-7796 or email to [contact@acwwa.ca](mailto:contact@acwwa.ca).

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# Updates and incorporation of climate resilience into the Atlantic Canada Water and Wastewater Design Guidelines

By Willard D'Eon, CBCL Ltd.

Climate resilient infrastructure, in general terms, refers to infrastructure that is planned, designed, built, and operated in a way that anticipates, prepares for, and adapts to, changing climate conditions. It can also withstand, respond to, and recover rapidly, from disruptions caused by these climate conditions. (OECD Environment Policy Paper No. 14, 2018). Considering climate change in long-lived infrastructure investments, including retrofits and upgrades, and investing in traditional and natural adaptation solutions can build resilience, reduce disaster risks, and save costs over the long term (GC, 2016).

The *Atlantic Canada Guidelines for the Supply, Treatment, Storage, Distribution, and Operation of Drinking Water Supply Systems* (Water Guidelines), and the *Atlantic Canada Wastewater Guidelines Manual for the Collection, Treatment, and Disposal* (Wastewater Guidelines) have typically been used in the design of water and wastewater infrastructure in Atlantic Canada in recent years, with the last updates for both documents being 2004 and 2006, respectively.

ACWWA has recognized the effects of climate on water and wastewater infrastructure, and in late 2018, secured funding and in-kind contributions which provided the foundation for an application to Natural Resources Canada's (NRCan) Building Regional Adaptation Capacity and Expertise (BRACE) program to fund the incorporation of climate resilience into the updates of the Guidelines. The funding request was approved and in early 2019, ACWWA prepared a Request for Proposals for "Incorporating Climate Resilience for Municipal Infrastructure into the Updates of Existing Atlantic Canada Water and Wastewater Design Guidelines." The project was awarded to CBCL Limited, with a project schedule of May 2019 to late 2020. All four Atlantic provinces are partners on the project and along with representatives from Halifax Water and the City of Charlottetown, form the Water and Wastewater Guidelines Review Committees.

Capacity Building is a major focus of the project, and the project includes a Knowledge Mobilization Plan, workshops, webinars, and presentations at local and national conferences. Stakeholders include consultants, equipment suppliers, managers of utilities, regulators, private developers, and provincial regulators, all of which utilize the Water and Wastewater Guidelines for infrastructure projects.

To initiate Capacity Building, four efforts are immediately underway:

1. A web portal has been established on the ACWWA website ([www.acwwa.ca/resources/water-wastewater-guideline](http://www.acwwa.ca/resources/water-wastewater-guideline)). This portal will provide a platform for stakeholders to upload and download documents

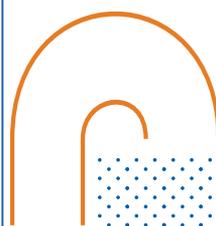
relevant to climate change/climate resilience and the updates of the Water and Wastewater Guidelines. A project schedule and opportunities for engagement will be kept up to date on the website.

2. A presentation on the project will be made at the ACWWA Halifax Conference on October 8, 2019.
3. The first of four workshops will be held on Wednesday October 9, 2019 to coincide with the ACWWA Conference in Halifax. (The other workshops will be held in New Brunswick, Newfoundland and Labrador, and Prince Edward Island. The dates and venues will be determined as the project moves forward.) Registration for the workshops will be provided through the web portal.
4. An abstract has been submitted for a presentation at the Adaptation Canada Conference to be held in Vancouver in February 2020.

We look forward to your engagement on this project to ensure that the updates to both guideline documents reflect the needs of the region from both a climate resilience and design perspective. Please feel free to reach out to me ([willardd@cbcl.ca](mailto:willardd@cbcl.ca)) or to Clara ([contact@acwwa.ca](mailto:contact@acwwa.ca)) for more information on this initiative. 

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The **One AWWA Operator Fund** is funded through the support of American Water Works Association's *The Water Equation Campaign* and the Atlantic Canada Water and Wastewater Association (ACWWA). It is awarded in the amount of up to \$2,000 for Atlantic Canadian Water Operator training and education.

The Fund can be used for certification, operator-related conferences, water-related associate degrees, technical school programs, professional training programs, and books and manuals related to the water industry.

**Number and value:** Up to \$2,000 in total is available each year and may be dispersed to multiple recipients. Applicants may apply for any amount up to \$2,000. Successful recipients are also awarded a one-year membership

to the American Water Works Association and the ACWWA.

**Tenure:** One-time (non-renewable)

**Eligibility:**

- Applicant must be a current water operator or seeking to enter the water operator profession.
- Applicant must be pursuing professional development or technical enhancement related to the water operator profession, or an Operator's License or Certification.
- Disbursement of the funds will be made directly by the Section to the applicant.
- Items related to books, manuals, conferences, professional development courses, and other eligible expenses will be reimbursed to the recipient upon presentation of original receipts.

- Applicant must reside or work within the geographical boundaries covered by the sponsoring Section.
- Acceptance of scholarship constitutes permission to use recipient's name and scholarship story for purpose of promotion.

**Application process:**

The application shall include

- what the applicant is applying for, the amount of the request, and a budget to support the requested amount;
- a short biography, a recent photo, and contact information including name, phone number, mailing and email addresses;
- a 500-word statement or essay of the applicant's interest, knowledge, and future goals in the water/wastewater industry together with applicable work experience or extracurricular activities;
- names and contact information of two references that may be willing to speak on the applicant's behalf if contacted.

ACWWA **accepts only electronic applications** which should be submitted online at [www.acwwa.ca](http://www.acwwa.ca) by **October 18, 2019**.

**Selection:** Selection will be based on the principle of open and equal opportunity and carried out by an ACWWA selection committee.

*The Atlantic Canada Water and Wastewater Association strives to create an inclusive, diverse, and equitable culture for all members, volunteers, and staff. The ACWWA is committed to proactively engaging a workforce of all experience levels and skillsets that reflects the changing demographics of those served by promoting volunteer opportunities that will encourage diversity at the board, committee, and membership levels of the association. The ACWWA understands that its success depends on the full utilization and engagement of all members.* 



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Bill Butler was a lifelong contributor to the water and wastewater industry in Atlantic Canada and a very active member of ACWWA and AWWA. Bill spent much of his career at the Saint John City's Water and Sewerage Department, but ended his legacy as the Commissioner of Community Services in Saint John. Two of Bill's biggest interests were people and water, which combined in his appointment as President of Water For People – Canada from 1994 until retirement. In whatever area Bill worked he showed enthusiasm, professionalism and, above all, a true interest in the people he worked with. He gave those working in the water and wastewater sector a sense of team pride in providing such essential services to citizens. Bill Butler passed away in 2018 and in his honour, ACWWA has established a yearly educational scholarship of \$1,500, where \$1,000 is awarded to the successful applicant and \$500 is donated to Water For People.

**Number and value:** One yearly cash award with a value of \$1,000 plus a one-year membership to the American Water Works Association and ACWWA. A \$500 donation to Water For People will be simultaneously given in the name of the ACWWA Bill Butler Scholarship.

**Tenure:** One year (non-renewable)

**Eligibility:** An applicant shall

- be registered as a student in a water/wastewater operations program in an Atlantic Canadian community college, institute of technology, or other institution; and
- intend to pursue a career related to the water or wastewater industry.

**Assessment criteria:**

- Academic record in last year of study (20%);
- Statement/essay (60%); and
- Work experience and extracurricular activities (20%).
- Preference will be given to a candidate with a demonstrated interest in working in the water or wastewater treatment, collection, or distribution sectors.

**Application:**

The application shall include

- name of the scholarship you are applying for;
- a short biography, a recent photo, and contact information including name, phone number, mailing and email addresses;
- a 500-word statement or essay of the applicant's interest, knowledge, and future goals in the water/wastewater industry together with applicable work experience or extracurricular activities;

- a description/list of planned future studies; and
- supporting documents including i) a transcript showing courses completed in the last year of study, and ii) a copy of passport (the page showing your name, nationality, and place of birth).

ACWWA **accepts only electronic applications** which should be submitted online at [www.acwwa.ca](http://www.acwwa.ca) by **October 18, 2019**. Scanned copies of supporting documents are required.

**Selection:** Selection will be based on the principle of open and equal opportunity and carried out by the *Scholarships Committee*. The award winners will be announced in the following February.

*The Atlantic Canada Water and Wastewater Association strives to create an inclusive, diverse, and equitable culture for all members, volunteers, and staff. The ACWWA is committed to proactively engaging a workforce of all experience levels and skillsets that reflects the changing demographics of those served by promoting volunteer opportunities that will encourage diversity at the board, committee, and membership levels of the association. The ACWWA understands that its success depends on the full utilization and engagement of all members.* 

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The Atlantic Canada Water and Wastewater Association (ACWWA) established this scholarship in 2010 in recognition of dedicated service rendered by long-time member and tireless ACWWA supporter, Lloyd Douglas. ACWWA is a 'Section' of the American Water Works Association (AWWA) and a 'Member Association' of Water Environment Federation (WEF). ACWWA is comprised of over 550 water professionals from Atlantic Canada representing the water and wastewater industry from a number of disciplines including System Design & Consulting, Utility Management & Operations, Academia & Students, and Service Providers & Contractors. The goals of the association under its Strategic Plan are to:

- Support industry best practices
- Provide our industry with an education for the future
- Promote information exchange in the water and wastewater industry
- Conduct annual conferences
- Enhance government relations
- Increase/optimize membership
- Improve our Association's effectiveness

**Number and value:** Up to five awards with a value of \$1,000 each plus a one-year student membership to the American Water Works Association (AWWA) and ACWWA (one winner for each Atlantic Canadian province: NB, NL, NS, and PEI, and one available to the next strongest applicant)

**Tenure:** One year (non-renewable)

**Eligibility:** An applicant shall

- be registered as a full-time student at a university in Atlantic Canada;
- have successfully completed at least one year of postsecondary education; and
- intend to pursue a career related to the water or wastewater industry.

**Fields of study:** University degree in engineering/science

**Assessment criteria:**

- Academic record after at least one year completion of postsecondary education (30%);
- Statement/essay (60%); and
- Work experience and extracurricular activities (10%).
- Preference will be given to a candidate with a demonstrated interest in working in the water or wastewater treatment sectors.

**Application:**

The application shall include

- name of the scholarship you are applying for;
- a short biography, a recent photo and contact information including name, phone number, mailing and email addresses;
- a 500-word statement or essay of the applicant's interest, knowledge and future goals in the water/wastewater industry together with

applicable work experience or extracurricular activities;

- a description/list of planned future studies; and
- supporting documents including i) an official transcript completed to date, and ii) a copy of passport (the page showing your name, nationality, and place of birth).

ACWWA **accepts only electronic applications** which should be submitted online at [www.acwwa.ca](http://www.acwwa.ca) by **October 18, 2019**. Scanned copies of the supporting documents are required.

**Selection:** Selection will be based on the principle of open and equal opportunity and carried out by the Scholarships Committee. The award winners will be announced in the following February.

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As the publisher of *Go With the Flow*, the official publication of the Atlantic Canada Water and Wastewater Association, Craig Kelman & Associates has a deep appreciation for the readers and members of ACWWA whose task it is to ensure that water taken from and put back into our precious mother earth is clean and safe for the people, animals, and plants whose very existence depends upon it. To demonstrate their admiration and respect for the association, its members, and the water industry as a whole, they have established a yearly educational scholarship of \$500 to be funded through a percentage of advertising sales generated in *Go With the Flow*.

**Number and value:** One yearly cash award with a value of \$500 plus a one-year membership to the American Water Works Association and ACWWA.

**Tenure:** One year (non-renewable)

**Eligibility:** An applicant shall

- be registered as a student in a water/wastewater related program in an Atlantic Canadian community college, institute of technology, or other institution; and
- intend to pursue a career related to the water or wastewater industry.

**Assessment criteria:**

- Academic record in last year of study (20%);
  - Statement/essay (60%); and
  - Work experience and extracurricular activities (20%).
- Preference will be given to a candidate with a demonstrated interest in working in the water or wastewater treatment, collection, or distribution sectors.

**Application:** The application shall include

- name of the scholarship you are applying for;
- a short biography, a recent photo, and contact information including

name, phone number, mailing and email addresses;

- a 500-word statement or essay of the applicant's interest, knowledge, and future goals in the water/wastewater industry together with applicable work experience or extracurricular activities;
- a description/list of planned future studies; and
- supporting documents including i) a transcript showing courses completed in the last year of study, and ii) a copy of passport (the page showing your name, nationality, and place of birth).

ACWWA accepts only electronic applications which should be submitted online at [www.acwwa.ca](http://www.acwwa.ca) by **October 18, 2019**. Scanned copies of supporting documents are required.

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# WATER DISPATCHES

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Stephanie Gora, PhD



Water Dispatches is an interview series with ACWWA members on interesting topics that impact the water industry in Atlantic Canada. Stephanie is a

Postdoctoral Fellow at the Centre for Water Resources Studies at Dalhousie University and is the host of Water Dispatches. Her favorite water-related song is “The Water” by Feist.

Water Dispatches Technical Assistant:  
Matt Cavanagh



Matt is a Technical Sales Representative at Atlantic Purification Systems Ltd. and is a technical assistant with Water Dispatches. Matt’s favorite water-

related song is “And it Rained All Night” by Thom Yorke.

Interviewee:  
Ben Trueman, PhD



Ben is a Postdoctoral Fellow at the Centre for Water Resources at Dalhousie University. His favorite water-related song is “The River” by Bruce Springsteen.

*Our Water Dispatches host, Stephanie Gora, caught up with Dr. Ben Trueman at Dalhousie University to talk about lead and manganese in drinking water.*

**Ben is the resident lead expert at the Center for Water Resources at Dalhousie University, so I thought I’d ask him to sit down with us and talk about lead and a little bit about manganese as well. Welcome, Ben.**

Hi, glad to be here.

**Can you tell me a little bit about your educational and research background?**

I did my PhD here at The Center for Water Studies at Dalhousie and my research work during my PhD focused on two things really: human exposure to lead in drinking water – understanding it, measuring it, and also the chemistry of lead mobility in drinking water systems.

**What initially led you to become interested in lead and manganese?**

I think it was the fact that these problems keep cropping up. We keep having major issues with drinking water quality that involve either lead or manganese.

**Why should the general public care about lead in their drinking water?**

Lead is a potent neurotoxin. There is no safe level of exposure that’s been documented. This is especially important for exposure in the population of young children. In adults, it’s less of a concern but lead is linked, even at environmental sort-of ambient concentrations, with cardiovascular disease mortality.

**Quick follow up question. Is it normal for people to get most of their lead exposure from water, or are there other sources that are important?**

Lead is a vexing environmental problem because there are so many sources of exposure. Drinking water is an important source, sometimes the dominant source, but there are also significant concerns surrounding lead paint; lead in gasoline was a huge issue for decades and that has

resulted in significant contamination of soil with lead. There are plenty of sources.

**In terms of water quality, is there anything there that can impact the amount of lead that arrives at the tap?**

In most cases lead in drinking water comes from legacy drinking water system components. So that would be old lead pipes that are buried within the system, brass that contains lead, lead-tin solder in copper pipe networks within buildings, these are all sources. They are released at greater rates when the water is more acidic at a lower pH and also due to the presence of things like natural organic matter, ions like chloride, etc. All these things can have an effect on whether the legacy lead in old drinking water systems is released or stays put.

**Is there anything special about Atlantic Canada that would cause more or less lead release?**

Many communities in Nova Scotia are potentially at risk. There's not a lot of information on lead in drinking water in Nova Scotia, but I would say many communities are potentially at risk just because they are older communities and are likely to contain older homes with potential sources of this legacy lead and older distribution networks that may contain sources of lead.

**From what I understand, there are many different ways to take a lead sample. It's not just a matter of quickly putting a glass under the tap and taking a little bit of water out and sending it to a lab. Could you maybe expand on the different types of lead sampling?**

Sure. Lead sampling varies in terms of the method depending on the goal. So one goal that we might reasonably want to achieve would be characterizing human exposure. Surprisingly enough, one method is a random daytime sample at sources where we would like to characterize the human exposure. Another method is to include a prescribed 30-minute stagnation period prior to collecting a sample, which is also reasonably predictive of exposure. Of course, the best way is actually to take a little bit of every volume of water that's used for consumption and get an average exposure reading from that.

For example, in the United States the USEPA mandates a specific type of sampling involving a prescribed minimum six-hour stagnation period prior to collecting a sample in order to characterize corrosion control performance. As water sits within pipes, it tends to accumulate lead if there is a source of lead present within those pipes. The stagnation time really matters in terms of the amount of lead that you're actually getting in the water.

**I know lead is fairly widespread in water distribution systems in North America; you've told us a few sources. I was wondering if you could expand on some of the more high-profile cases of lead-related issues that have come up in the last five to ten years?**

I think there are two important case studies that help to illustrate what can happen when we forget about lead, or

when we make mistakes with respect to managing lead as a risk. The most recent high profile case was Flint, Michigan. There was a previous example of similar types of mismanagement that occurred in Washington D.C. in the early 2000s, which was much larger in scale. They were both driven, in a way, by similar sorts of poor decision making involving making changes to the type of drinking water that's distributed and its characteristics without taking lead into account.

**So, as a utility, what would be the best way to take positive action? What would be their best approach to managing lead in the distribution system?**

A water provider really needs to have a comprehensive approach to deal with a problem like this. That's going to involve action to both alter the chemistry of drinking water so it's less likely to leach lead from legacy sources and also a comprehensive monitoring program to understand how that's working. The third component really, and essentially is removal of legacy system components, which is very difficult and fraught with complications, has to be a part of any lead management program.

**So now, for an individual person in their home, what's the best way for them to minimize their exposure to lead?**

I think the best way to manage exposure to lead is probably a point-of-use removal device that is certified for lead removal. Not all are, but some do it very well.

**Would this be something that somebody, say in Halifax, would need to put on their drinking water tap or is it just if you know there is a really high level of lead?**

The other important aspect of managing your own risk would be actually having your water tested. Many drinking water utilities will provide this as a service at no cost. That would help to determine if there is a problem for you. In any case, point-of-use removal is reasonably affordable and a good way of ensuring that there is no risk for the people consuming that water.

**Manganese is another metal that we're hearing a lot about with respect to drinking water right now. It has been regulated for many years as an aesthetic parameter in many Canadian jurisdictions but Health Canada has recently come out with a health-based guideline for it. What prompted this change? Why the push to regulate it as a health concern?**

As I understand it, Health Canada has based their new maximum acceptable level concentration for manganese on epidemiological studies in human populations, about the health effects of manganese but also on experimental studies based on animal models, both showing similar results in terms of health effects of manganese at environmentally relevant concentrations.

**Where does manganese come from? Is it something that comes off pipes or is it somewhere else?**

Manganese is a bit different than lead in that the primary origin is from source water itself. Of course, it does accumulate within distribution systems and so it does come off pipes as well. It can be released sporadically from accumulated deposits within drinking water systems.

**I see, but it's mostly coming from the source, which is different from lead. I guess that would also affect the ways people protect themselves from being exposed to manganese. What can a utility do to minimize manganese at the tap?**

For a utility the best way of minimizing manganese at the tap is removal at the source and there are various established treatment solutions available to be able to do that.

**How about an individual in their home, what can they do about manganese? Should they have to do anything about manganese?**

I would say, for manganese it's probably a little bit easier to determine whether it's going to be a problem. This is something that, for starters, may be obvious from the appearance of black deposits on fixtures in your home, but also it's the information that can be available from utilities more readily because if they measure manganese in their treated water that's likely going to reflect to a greater extent than lead what is actually expected at the point-of-use where you're actually consuming the water. As with lead, point-of-use removal devices certified for the removal of manganese are effective ways of protecting yourself if there is a problem.

**Do you think that most water treatment plants in Canada will be able to meet the upcoming manganese health standard?**

I don't know if I can comment extensively on the feasibility of this recommendation other than to say that I know it will be a problem for some specific utilities that have had historical issues with manganese and don't have treatment systems that are commensurate to the task of removal.

**You recently published a paper that I got involved with about the potential interactions between lead and manganese in drinking water systems\*. From that paper, but also from your experience, are there any interactions between lead and manganese even though they're so different?**

Manganese, once it is oxidized in a drinking water system, precipitates as manganese oxides that are black in color. These compounds are scavengers for lead. So lead, and other heavy metals for that matter, tend to accumulate on their surfaces. Manganese, once oxidized to manganese IV, is an oxidant that can actually participate in the corrosion and release of lead. The extent to which these interactions actually govern lead concentrations at the tap is not very well understood, but I think it's safe to say that controlling manganese could potentially be a means of reducing lead concentrations at the tap.

**All right, so in your opinion what's next for lead and manganese research?**

I think, in the case of manganese, Health Canada did express some concerns about the quality of some of the epidemiological studies that they reviewed. So perhaps additional epidemiological work on the effects of manganese on human populations at environmentally representative concentrations, like those present in drinking water, would be warranted. In the case of lead, I think one of the most important solutions for dealing with lead presently is adding orthophosphate. It's very effective, widely used, but phosphorus is, of course, a pollutant. It's expensive, and it's a critical agricultural resource so it would be extremely useful to find alternatives to orthophosphate for that purpose.

**I've always felt that corrosion control is a bit of a band aid solution.**

It is a bit of a band aid solution. Obviously the most important and the most effective solution to lead in drinking water is to remove the sources. But that's not happening at a rate that will make corrosion control obsolete. We still need corrosion control solutions until all those sources are gone, which could be quite some time.

**Thank you so much for taking time out of your day to come talk to me today.**

Absolutely. Thanks.

Do you have an exciting new project or initiative that you'd like to share with the ACWWA community? Get in touch with Water Dispatches at [waterdispatches@gmail.com](mailto:waterdispatches@gmail.com) to arrange an interview with Steph and Matt. The transcript of your interview will be shared in a future issue of *Go With the Flow*. 

For more information on the new Health Canada guidelines for manganese in drinking water, please visit [www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-manganese.html](http://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-manganese.html).

\*Trueman et al., *Environ. Sci. Technol.*, 2019. DOI: 10.1021/acs.est.9b00317



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# Students learning the importance of water systems & aquifers

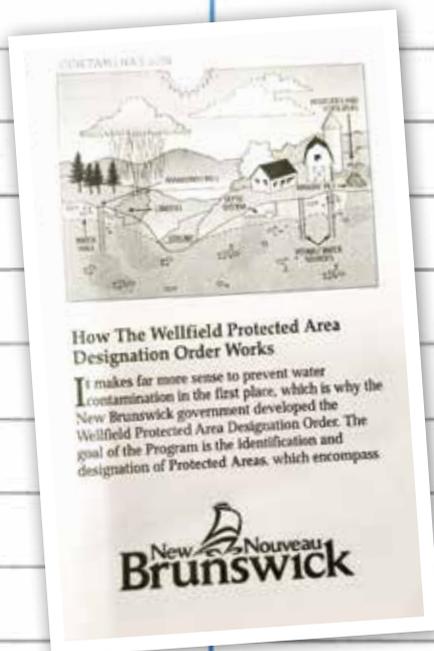
By Amy Winchester

Mme Chapman-Ross's Grade 8 French Immersion class at Harry Miller Middle School (Rothsay, NB) has been learning about the Wellfield Protection Program. As part of their program, they learned about the importance of water and about aquifers. The students had to build models of aquifer and make posters about how to support our water

systems instead of polluting them. They were tasked to answer the following questions:

1. Why is water important?
2. How can you conserve water?
3. How does water affect your daily lives?

Here are some highlights of the students' work. 



# Performance of lagoons

By John Lam

This article follows the article in our Spring 2019 magazine titled “Lagoons – how they work,” and expands on the removal of organics.

Organic matter in the raw wastewater is consumed in different ways in a lagoon. Much of the particulate matter settles to the bottom of the lagoon, typically in the first or second cell. The organics in the settled material are consumed by benthic organisms. This zone at the bottom of the lagoon is normally an anaerobic (absence of oxygen) environment. The more complex organic compounds are broken down into acids, biomass, and other compounds that are readily available for consumption by microorganisms. Aerobic (oxygen

available) microorganisms in the upper zone of the lagoon feed on the organic material, which is converted into biomass and typically settles to the bottom of the lagoon as sludge.

The rate of growth of the microorganisms are affected by several factors, as follows:

- Concentration of organic compounds (substrate)
- Water temperature and pH
- Dissolved oxygen
- First order reaction kinetics
- Hydraulic retention time
- Number of cells

Some of these factors have been established through experimentation and are available in the public domain. Other factors must be determined or assumed, such as the



concentration of organic compounds (carbonaceous biochemical oxygen demand or cBOD – refer to previous “Back To Fundamentals” article for a more detailed explanation of this) in the raw wastewater, temperature, and pH. The process designer has control over the variables such as hydraulic retention time (based on flow and size of cells), dissolved oxygen, number of cells and, to some degree, the pH in the lagoon. The first order kinetics formula can be written as follows:

$$\frac{L_e}{L_i} = \frac{1}{[1 + \frac{K_t T}{n}]^n}$$

Where:

- $L_e$  = Effluent BOD, mg/L
- $L_i$  = Influent BOD, mg/L
- $T$  = Total hydraulic retention time in lagoon (cell), days
- $n$  = Number of ponds (cells) in series
- $K_t$  = Reaction rate coefficient at temperature,  $t^{\circ}\text{C day}^{-1}$
- $K_t = K_{20} \theta^{t-20}$
- $K_{20}$  = Reaction rate coefficient, varies from  $0.276 \text{ day}^{-1}$  to  $0.138 \text{ day}^{-1}$
- $\theta$  = Temperature activity coefficient, typically 1.035

The value on the left hand side of the equation ( $L_e/L_i$ ) represents the portion of BOD remaining in the effluent. It is interesting to note that while hydraulic retention time ( $T$  in the above formula) has a large impact on effluent quality in terms of BOD, the number of cells has a greater impact. In other words, the more cells

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“The more cells there are in the lagoon system, the higher quality the effluent will be.”

there are in the lagoon system, the higher quality the effluent will be, in terms of BOD under the same operating conditions, within some limitations. For example, a two-cell lagoon with 30 days retention time in cell 1 and 15 days in cell 2 will theoretically produce the same effluent BOD as a three-cell lagoon with 10 days retention time in each of the three cells. This is due to improved mixing and reduced short circuiting in the system.

In order to increase the number of cells, designers can use HDPE baffles, earthen berms, or concrete walls. The advantage of using baffles compared to earthen berms is the reduced footprint, volume of raw materials, and cost used for construction of the lagoon. However, baffles offer disadvantages such as not allowing independent dewatering or drawing down of the cell, and they can rip or tear more easily than a traditional berm. 

The “Back to Fundamentals” department is published in each edition of *Go With the Flow* magazine. It is intended to cover a broad range of fundamental water and wastewater topics that will be driven by you, the readers of this magazine. If you find a topic particularly interesting or confusing, most likely others do as well. Please forward your ideas for future columns to Kyle MacIntyre, Dillon Consulting ([kmacintyre@dillon.ca](mailto:kmacintyre@dillon.ca)) or John Lam ([john.lam@novascotia.ca](mailto:john.lam@novascotia.ca)) and we will respond in future publications to your queries.

## Health Canada water guidelines news



**Copper** – Health Canada has established a new health-based guideline (MAC) of **2 mg/L** and reaffirmed the aesthetic objective (AO) of **1 mg/L** for total copper in drinking water. They also developed new sampling procedures designed to more accurately reflect public exposure to copper through drinking water. Previous sampling protocols may have underestimated exposure as the faucet was flushed prior to sample collection. While the new guideline is effective immediately, the sampling protocols will take longer to implement. We are currently working on developing requirements for both lead and copper. More information is available on the Health Canada website, at [www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/copper.html](http://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/copper.html).

**Strontium** – Health Canada developed a new health-based guideline of **7 mg/L** for total strontium in drinking water. More information is available at [www.canada.ca/en/health-canada/services/publications/healthy-living/water-talk-strontium.html#a1](http://www.canada.ca/en/health-canada/services/publications/healthy-living/water-talk-strontium.html#a1).

**Uranium** – Health Canada reaffirmed the health-based guideline of **20 ug/L** for total uranium in drinking water. The document was updated to reflect current science. More information is available at [www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/water-talk-uranium-drinking-water-2010-health-canada-brochure.html](http://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/water-talk-uranium-drinking-water-2010-health-canada-brochure.html).

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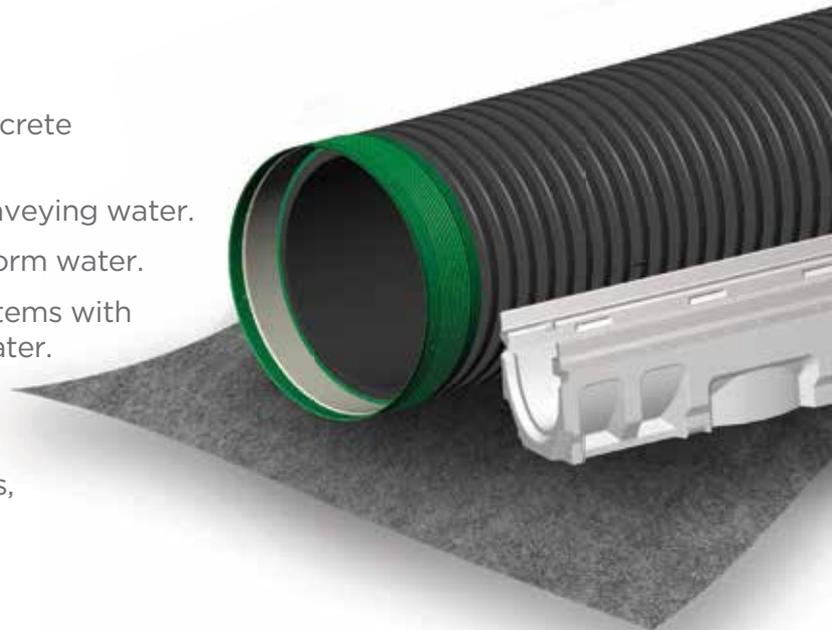
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