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in Canada

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Ensuring a safe, secure water
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VOLUME 25 NUMBER 1

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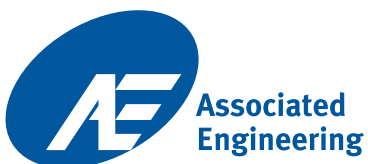
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Cover image:

Workers installing the New Port Mann Main with the assistance of dewatering equipment, which includes a series of small wells that pump out ground water through a common pipe header. Together, they work to lower the ground water level in the vicinity of the excavation, making the excavating, backfilling, and compaction more manageable.

Courtesy of Metro Vancouver

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DAVID MAIN
BCWWA President

'RESILIENT, RESOURCEFUL AND READY' IS A GREAT WAY TO DESCRIBE TODAY'S BCWWA

Over the past year, I have had the privilege of introducing each edition of the BCWWA *Watermark* in the President's Message. Since this will be my final opportunity to use this page as my own personal BCWWA soapbox, I took a few moments to think about my time as a BCWWA board member over the past few years, and the last year as president, which gave me the opportunity to really get to know the BCWWA. Ed Burke (our *Watermark* staff editor) reminded me that the theme of this issue and the 2016 Annual Conference is "Resilient, Resourceful and Ready." Almost instantly, this theme exactly captured my thoughts regarding BCWWA's organizational strengths and resources.

BCWWA has a history that goes back more than 40 years. It began with a foundation that was based upon the need for operator training within our water and wastewater systems. I

opened my first President's Message with my thoughts on some of the most significant challenges facing our industry, and at the top of the list was our response to a rapidly changing workforce. In fact, our workforce had already changed around us, but our well-worn operator training models were still rooted in practices that were becoming dangerously obsolete. The BCWWA has expended considerable effort in the past year to redesign strategies to meet the changing needs and demands of a new water sector workforce. The days of a one-size-fits-all model for training are over and resilience demands models that are in sync with the workforce of today and tomorrow. It is still early days for our extensively redesigned training strategy and I am excited to the many changes that are now in progress. In the coming year, I am looking

forward to hearing from our current and future operating training stakeholders about our changes and training outcomes.

One thing that has always been at the very top of BCWWA's list of strengths is our organizational resourcefulness. We seem to prove time and time again that we can accomplish results that are well above our pay grade. Beyond the efforts of our dedicated team of BCWWA staff, I am proud to see the continued strength in BCWWA's amazing network of volunteers. While many non-profits have had challenges in attracting an able and willing volunteer network, the BCWWA is fortunate that the spirit of volunteerism is alive and well in our industry. In my full-time job at AECOM, many of our Young Professional staff ask me about BCWWA volunteer opportunities, and I know that the same exists in many other agencies within our industry. Even my teenage daughter spent part of her summer last year as a BCWWA volunteer. Our volunteer board and committees include some of our most knowledge and experienced water professionals, all of whom enjoy spending time and energy to enable the BCWWA to achieve our mission. It is because of our resourcefulness that we can accomplish so much from year to year.

**"BEYOND THE EFFORTS OF OUR DEDICATED
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But perhaps “Ready” expresses where I think the BCWWA has made new progress in the last couple of years. I see this in the responses that the Association has provided senior levels of government on pending legislation and regulations. We operate in an environment where regulatory change can have a major impact on our water, wastewater and stormwater systems, and on the cost of operating these systems. While new legislation and regulations may be warranted, there is a potential to miss the mark and create unnecessary work and frustration. Over that past few years, the BCWWA has provided well-informed and critical input to regulators in a growing range of pending legislation/regulations. Responses that are accurate and based on modern technology and means help new legislation successfully achieve the desired requirements without unnecessary and possibly expensive bureaucracy. In fact, the BCWWA responses have been so well received that some of these regulatory agencies now reach out to the Association proactively in order to get the focused and well-researched input they need.

“IT HAS BEEN AN HONOUR AND PLEASURE TO COMPLETE MY TERM AS YOUR BCWWA PRESIDENT.”

This “new” ability is not that new at all. It is a result of a long effort in developing a broad range of BCWWA Position Statements on almost all of the important matters that are now affecting our industry. This in itself has taken more than five years of volunteer and BCWWA staff effort. BCWWA Technical Committees include many of our industry’s top specialists. With the right subject matter experts in hand, BCWWA staff organize the charge. The result is that the BCWWA now has a reputation as a knowledgeable and non-political sounding board that can provide advocacy positions on most matters that impact our water resources. If you have not had a chance to examine the BCWWA Position Statement library, they are available on the BCWWA website at www.bcwwa.org/resources/position-statements.

So after this year as president of the BCWWA, I now understand the Association and perhaps most of its workings. For me, one of the most productive exercises that I took part in was playing a governance role in the development of our current BCWWA Strategic Plan. While the plan took many months to coalesce, it is actually pretty easy reading and it clearly identifies where we as an organization need to go, and how we will get there. It is one thing to produce the plan, but it is now especially gratifying to see the progress we are making in keeping the BCWWA Resilient, Resourceful and Ready. I urge you all to download and read the 2016 BCWWA Strategic Plan at www.bcwwa.org/about/about-us. It has been an honour and pleasure to complete my term as your BCWWA president. 💧

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TANJA McQUEEN
Chief Executive Officer

BUILDING AN ASSOCIATION THAT IS RESILIENT, RESOURCEFUL AND READY

The BCWWA has a long, proud history serving the people who work every day to keep our water systems clean and safe, from source to tap to drain and back to the environment. We provide excellent professional development events and training opportunities, deliver industry certification programs, and present a cohesive voice for issues that are important to our members.

Over the past several years, we have implemented a number of changes to ensure that the Association continues to be resilient, resourceful, and ready to serve the industry that protects public health and the environment. Our work is guided by a strategic plan that outlines a vision for the future, the goals we are working to accomplish, and the strategies that define our priorities for action. A summary of the 2016-2018 Strategic Plan can be found on our website at www.bcwwa.org/about/about-us.

In 2016, our priorities include further enhancements to our Operator Education program, increasing the number of professional development events, launching a new small

water systems program, updating our back-office systems, and maintaining the high quality of our information products for members.

We continue to expand our information resources to ensure that our members are informed about industry trends. For example, we recently completed important research, in partnership with the EOCP, to profile the water sector workforce; for the first time, the industry has BC-specific quantitative information about the size, composition, and dynamics of the workforce, to inform staff recruitment, retention, and training. The Executive Summary is enclosed with this issue of *Watermark* magazine, and the full report can be found on our website at www.bcwwa.org/resources/research-reports.

As I write this, it has been almost three years since I joined the BCWWA as CEO. Over that time, my focus has been on four main priorities:

1. Creating and implementing a strategic plan that aligns with the goals established by the Board of Directors;
2. Building a high performance team that activates the strategy and provides value to our members;

3. Setting and modelling the organization's culture, built on respect, transparency, teamwork, and excellence; and
4. Evaluating, monitoring and reporting on our performance.

It has been a very rewarding time for me. I am immensely proud of the exceptional team of staff, volunteers and board members that we have attracted to the organization, and the work they do every day to serve our members. It is the best team that I have ever worked with.

Which is why I have mixed feelings about my upcoming retirement. As of June, my husband and I are moving into the next stage of our lives. We are looking forward to having time to do the things we enjoy and spending time with the next generation of our family; at the same time, I will be sad to leave such a wonderful group of people.

The BCWWA is an organization that is resilient, resourceful and ready for the future. Thank you for the opportunity to serve you. I know you will be in good hands. 💧



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COLWYN SUNDERLAND
CWWA Director

SUNNY WAYS FOR WATER?

We have a new government in Ottawa

that is working hard to show how different it is from the previous one. Last fall, it very successfully differentiated itself from its rivals on both the left and right by campaigning on a borrow-and-spend financial model centered on infrastructure investment as one of its three primary platform planks. The Liberals have also committed to “provide national leadership and join with the provinces and territories to take action on climate change.” These promises are rapidly being translated into plans as the 2016 budget is prepared, while government is faced with stark economic realities including rock-bottom oil prices and a weak loonie. What does all of this mean for Canada’s water sector, and what can we do to ensure our needs and interests are duly considered as the new government’s infrastructure plans develop and launch?

HOW BIG IS THE PIE?

In its election platform, the Liberal Party proposed to run deficits of \$9.8 billion in 2016/17 and \$9.5 billion in 2017/18, in part to fund a \$5 billion increase in annual infrastructure spending. The Conservatives launched the current “New Building Canada Plan” funding program in its 2013 budget, with a total annual investment level of

approximately \$5 billion. The Liberal commitment effectively doubles the size of the pie to \$10 billion annually.

HOW BIG A SLICE SHOULD WATER GET?

Of the Liberal commitment, \$1.675 billion was earmarked for “green infrastructure” including, “local water and wastewater facilities, climate resilient infrastructure, clean energy, and clean-up of contaminated sites to facilitate new construction.” Although it is difficult to ascertain what share of the existing funding is reaching the water sector, the recent funding announcements under the application-based New Building Canada Fund-Small Communities Component (NBCF-CC) and Gas-Tax-Strategic Priorities Fund (GT-SPF) programs in BC provide some indication: Water and wastewater projects combined represent 73% of NBCF-CC funding and 42% of GT-SPF projects announced this year.

However, these are mostly small community projects. When national and provincial infrastructure (1/3 of total funding, primarily for transportation) and large municipality projects (half of BC’s funding, also primarily for transportation) are considered, water’s share diminishes to a smaller fraction of the total funding. We can therefore probably

assume that the new investments promised by the Liberals will be in similar proportions to the existing funding.

WHAT SHOULD WE DO ABOUT IT?

In Ottawa, countless organizations are busy expressing their urgent funding needs to the federal government, hoping for a bigger slice of the bigger pie. Should the water sector argue for a larger share, perhaps at the expense of the transportation, recreation or solid waste management sectors? These arguments may not be in the best interest of cities, which can usually recover the full costs of water and wastewater services through utility rates.

However, utility rates in many communities are under upward pressure due to climate change and the introduction of the federal *Wastewater System Effluent Regulation*. These two issues seem well aligned with the priorities of the new federal government. Also, funding for stormwater infrastructure is conspicuously almost completely absent from the recent NBCF-CC and GT-SPF announcements in BC, at a time when climate change is threatening the capacity of virtually all our existing infrastructure. Should we advocate for funding of new approaches that efficiently combine built and natural stormwater assets to adapt to increasingly extreme weather?

CWWA has been cultivating relationships with the new federal government through several channels, both directly and through powerful national partners such as the Federation of Canadian Municipalities. As funding for local government projects flows through the provinces, it will be more important than ever to coordinate messaging with regional partners, including the BCWWA. As we develop these relationships, I am interested in how you might answer the questions posed in this column. Feel free to call me at 250-294-8029 or send an email to csunderland@kwl.ca to share your views on this important topic. 💧

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BCWWA Membership News

BCWWA 2016-17 BOARD ELECTIONS:

An election is held each year to fill vacant positions on the Board. Two positions were up for election this year:

1. President Elect; and
2. Director at Large (one to be elected).

Voting closed at noon on April 12, 2016. Thank you to all our members that cast their vote! Election results will be announced at the BCWWA Annual General Meeting (AGM), which takes place on May 2, 2016 during the 44th BCWWA Annual Conference & Trade Show.

President Elect

President Elect Chris Johnston (Kerr Wood Leidal), currently a Director at Large, has been elected by acclamation as President Elect for 2016-17.



Chris Johnston — Vice President, Kerr Wood Leidal Associated Ltd.

Chris Johnston is a consulting engineer and has been a BCWWA Director at Large for the past three years, and is now your President-Elect.

Chris has been involved in numerous BCWWA

Technical Committees since 1992, including the Small Water Systems Committee (Chair), the Watershed

Management Committee (Chair), the Collection Systems Committee, and the Climate Change Committee. He has been Chair and Vice Chair of BCWWA's Leadership Council for the last three years. Chris served as the BCWWA representative on the Water Environment Federation's (WEF) House of Delegates from 2006 to 2009.

With his 24-year history with the BCWWA, Chris certainly knows the organization's

history and the changes it has gone through. "We have now become a mature organization and have accomplished many of the goals that have previously been set. However, we still face some challenges both in terms of addressing industry issues raised in membership surveys and organizational financing to ensure our achievements can be sustained."

Director at Large Candidate Statements

Two candidates, Stephen Horsman and Rosemary Smart, ran for the Director at Large position. Each candidate was asked four questions.

The answers to two of those questions are featured here. For the answers to all of the questions, please visit www.bcwwa.org/governance/board-elections.



Stephen Horsman — Water Supply and Treatment Engineer, AECOM

What are the top three reasons that you would like to join our Board?

1. I value the contribution the BCWWA makes to the water and wastewater industry and am keen to work with

the Board to develop initiatives on behalf of the membership in response to key issues impacting the future of our industry, including: infrastructure resiliency, sustainable water management, knowledge transfer, and accurate asset valuation to name a few.

2. To participate in advancing agendas and policies that will safeguard the water and wastewater industry for future generations. As a father of four children, I have a significant investment in the future of our industry and the health and safety of our local environment.
3. To serve the water and wastewater industry in a meaningful way by collaborating with industry representatives at the governance, planning, engineering and operations levels to provide a united voice for our membership.

What do you bring to the Board in experience, accomplishments, attributes and insight?

I am passionate about protecting the health of our waterways and safeguarding sustainable and reliable access to drinking water throughout BC and the Yukon. Having worked in the municipal water and wastewater industry for nearly ten years, I will leverage my knowledge and experience implementing policy and standards at the planning, design and asset management levels to provide informed insight into the key issues facing our industry.



Rosemary Smart — Corporate Administrative Officer, Hagensborg Waterworks District

What are the top three reasons that you would like to join our Board?

1. To represent the members, I will bring to the table a voice for, and perspective from, small

water systems and over 200 Improvement Districts.

2. Supporting BCWWA's "End goals," I will provide the boots-on-the-ground feedback on planning and moving forward. I will inform my sphere of influence to bring new membership to this dynamic service.
3. With 35 years' experience as a business owner and 15 years as a corporate

administrator to Waterworks District, I tend to think spatially at an organizational level, am highly organized and structured, and understand budgets, financial reports and metrics. I will always seek succinct solutions to increase efficiency rather than belabouring problems.

What do you bring to the Board in experience, accomplishments, attributes and insight?

I was instrumental in developing the community consultation process working with local and provincial government, the Vancouver Health Authority and related engineers to

gain approval and total support to undertake a pilot project for state-of-the-art point-of-entry purification for a large community.

Through the noted community consultation process, and working with engineers and accountants, I was able to gain support from the community to raise their taxes 500% to ensure sustainability.

Successfully gained the support of the BC Chamber of Commerce at the BC Chamber's 2015 AGM, which formally adopted an appeal to the provincial funding policy, a policy that, by the government's own admission, intentionally starves a level of local government.

It doesn't get more collaborative than that.

2016 MEMBERSHIP FEE CHANGE

On April 1, 2016, BCWWA membership fees changed to \$99 per year for all members, except students.

Why? We have raised our membership fees in order to keep up with the rising cost of delivering high-quality products and services to our members over the past decade. Over the past few years, the Association has expanded the scope of services offered to members, including public education and advocacy to government; training courses; educational and networking events; and information products for our members. But these services cost the Association over \$200 per year, per member, and our membership rates need to move towards full cost recovery.

As a BCWWA member you are able to:

- Access preferred rates for quality training and professional development events.
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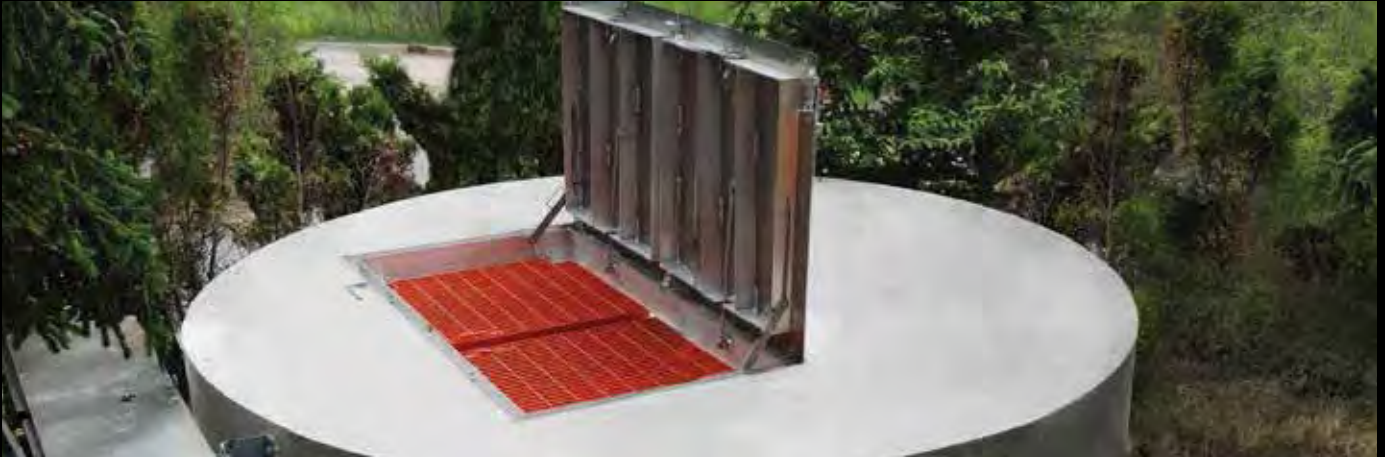
is more than just talk

As we continue to deliver valuable information through the pages of this magazine, in a printed format that is appealing, reader-friendly and not lost in the proliferation of electronic messages that are bombarding our senses, we are also well aware of the need to be respectful of our environment. That is why we are committed to publishing the magazine in the most environmentally-friendly process possible. Here is what we mean:

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- Our computer-to-plate technology reduces the amount of chemistry required to create plates for the printing process. The resulting chemistry is neutralized to the extent that it can be safely discharged to the drain.
- We use vegetable oil-based inks to print the magazine. This means that we are not using resource-depleting petroleum-based ink products and that the subsequent recycling of the paper in this magazine is much more environment friendly.
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- We ensure that an efficient recycling program is used for all printing plates and all waste paper.
- Within the pages of each issue, we actively encourage our readers to REUSE and RECYCLE.
- In order to reduce our carbon footprint on the planet, we utilize a carbon offset program in conjunction with any air travel we undertake related to our publishing responsibilities for the magazine.

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THE OTHER GUYS



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BC MINISTRY OF HEALTH GROUND WATER GUIDANCE DOCUMENTS UPDATE

The BC Ministry of Health is pleased to announce the completion and public release of two provincial guidance documents:

1. Guidance Document for Determining Ground Water at Risk of Containing Pathogens (GARP), Version 2; and
2. Drinking Water Treatment Objectives (Microbiological) for Ground Water Supplies in British Columbia, Version 1.

The purpose of these guidance documents is to clarify provincial legislation, promote best practices, and provide transparency and consistency to the determination of ground water at risk and the level of treatment that might be required of a ground water system to mitigate hazards and address the microbiological quality of the drinking water source.

These documents were developed with the support of the regional health authorities and an extensive three-year consultation period with industry, consultants, water suppliers, municipal representatives, and staff from provincial agencies. The Ministry of Health would like to thank all those who worked as part of the technical committee, and the many stakeholders who provided written input to the Ministry and/or attended the in-person consultation sessions in their community.

The updated documents are available to download from the resource section of the BCWWA website at www.bcwwa.org.

16TH EDITION OF THE ASSET MANAGEMENT NEWSLETTER

Check out the winter edition of the Asset Management BC e-newsletter at www.assetmanagementbc.ca.

Topics include:



- Eco strategies: Why we need to integrate natural capital into asset management;
- Getting the most from infrastructure assets: The idea of ecological accounting;

- Useful performance measuring; and more.

For questions, feedback or newsletter contributions, please email info@assetmanagementbc.ca.



Image credit: District of Sechelt

FCM ANNOUNCES 2016 SUSTAINABLE COMMUNITIES AWARD RECIPIENTS

The Federation of Canadian Municipalities (FCM) recently announced the recipients of the 2016 Sustainable Communities Awards, showcasing the very best in local environmental practices. Canada's municipalities are recognized as consistent drivers of innovation, delivering local actions that lead to national results.

The 2016 FCM Sustainable Communities Awards winner in the Water category is the District of Sechelt's new Water Resource Centre, a community-friendly facility that uses an advanced odour-free method to turn wastewater into high-quality reclaimed water and biosolids. Located in the middle of town, the new facility exceeds the treatment capacity of the two older wastewater treatment plants it replaces.

Source: FCM | January 20, 2016

UBC RESEARCH HELPS SMALL MUNICIPALITIES MANAGE AGING WATER SYSTEMS

UBC researchers have developed a tool that is designed to help small to medium-sized cities and towns address the challenges posed by aging drinking water infrastructure in Canada.

The tool, developed by Solomon Tesfamariam and Rehan Sadiq who are civil engineering professors at UBC's Okanagan campus, helps municipal water system operators and managers better understand the state of their infrastructure, most of which is hidden from the human eye.

The tool is designed for smaller jurisdictions to assess and understand their water systems and compare them with like-sized cities and towns by helping them:

- Understand what data is important to collect;
- How to collect that data;
- How to develop inventories of the various elements of a drinking water supply system, including infrastructure related to source water, treatment and water distribution;
- Use an asset management framework that helps decision makers determine how best to invest limited resources in renewing their water systems.

Source: UBC Okanagan News | February 16, 2016

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People on the move



MIKE IPPEN



Mike recently started working for the City of Victoria. He is now the Manager of Utility Operations, responsible for maintenance and repair of the city's

water, wastewater and storm drain systems.

Mike has worked in municipal utility operations for over 30 years. He began his career with the District of North Vancouver before moving to Vancouver Island in 1994. Mike is thrilled to be working with the Engineering team at the City of Victoria; a positive environment where emphasis is put on outstanding service.

Says Mike; "I'm excited for the opportunity to make a valued contribution."

In addition to his management role, Mike sits on the Education Advisory Committee and is the Incoming President of the BCWWA.

LARRY FORD



Larry Ford has retired from his role at the City of Burnaby as Plumbing and Gas Inspector and cross connection control (CCC) Program Administrator. Larry had been with the city since 1993.

Larry's retirement plans included enjoying more time with family and the grandchildren, as well as his hobby of competitive slow-pitch softball. Larry will also be staying busy as a consultant in the commercial plumbing industry.

Larry looks forward to continuing to work with the BCWWA as a CCC exam proctor and member of the CCC Committee.

SIOBHAN ROBINSON



Kerr Wood Leidal Associates is pleased to announce that BCWWA member Siobhan Robinson, M.A.Sc., P.Eng. has been named a Women's Executive Network (WXN) 2015 Canada's Most Powerful Women: Top 100 Award Winner in the TELUS Future Leaders category. This prestigious award recognizes "exceptional young women who have distinguished themselves early in their careers, and who show tremendous potential to continue making their mark in the years to come." Winners are 30 years of age or younger and are chosen based on their career accomplishments, vision and leadership, and community service.

Siobhan is a Project Engineer with Kerr Wood Leidal Associates. Her experience ranges from water and wastewater treatment projects through to civil site servicing and asset management. She is passionate about empowering youth to pursue a career in engineering and has traveled extensively to present to students about career possibilities in engineering. She also is a member of Science World's Scientists and Innovators in the Schools Program. As the Vice Chair of the BCWWA Young Professionals Committee and the Chair of the Association of Consulting Engineering Companies British Columbia Young Professionals Group Steering Committee, Siobhan works to facilitate professional development for young engineering professionals across British Columbia.

ALINE BENNETT



Aline Bennett, M.A.Sc., EIT, is celebrating one year with Opus DaytonKnight as an Assistant Project Engineer after completing her

masters at UBC, where she researched nutrient recovery from wastewater.

At Opus, Aline works with the water and wastewater teams planning and designing water and wastewater infrastructure throughout the province. Aline is the webinar coordinator for the Canadian Water Network's Student and Young Professional Committee where she curates and hosts webinars to bring young professionals together to tackle cross-disciplinary water topics, and develop and connect young leaders in the industry. She is also a member of BCWWA's Wastewater & Residuals Management Committee.

GEORGE THORPE



Last year, George Thorpe, P.Eng., was honoured to receive a special gift at the RES'EAU-WaterNET meeting which happened concurrently with the 43rd BCWWA Annual Conference & Tradeshow in Kelowna, BC.

George was presented with a necklace made by Jim Brown, lead water plant operator for Lytton First Nation. Brown created a necklace with a brown bead symbolizing organics in water, a white bead to represent microbes in the water, a rock for dissolved minerals, and a blue bead for clean water once the others have been removed.

"I am giving this to George because he's the one that has managed to remove everything and make the water pure," said Brown as he presented the necklace to George. George is a member of RES'EAU-WaterNET and a partner of BI Pure Water, Inc.

"I think it is important for all (BC engineers) to see the RESEAU's report on a good working relationship for a successful project," says Jim Brown.

RES'EAU-WaterNET is a Natural Sciences and Engineering Research Council- strategic network group based out of UBC. RES'EAU-WaterNET is working closely with small, rural and First Nations communities (SRCs) to understand the limitations and constraints they face in order to design effective water systems.

BCWWA ADVISORY COMMITTEES

Congratulations to the following individuals who have recently been appointed as chair or co-chair of one of the BCWWA volunteer Advisory Committees:

- Doug Geller, chair of Water Sustainability Committee;
- Mike Homenuke, co-chair of Infrastructure Management Committee;
- Catherine Dallaire, co-chair of Infrastructure Management Committee;
- Crystal Campbell, chair of Watershed Management Committee; and
- Paul Young, chair of Young Professional Committee.

On behalf of the BCWWA members, staff and board, we extend our sincerest thanks to the following individuals for their leadership efforts on our Advisory Committees:

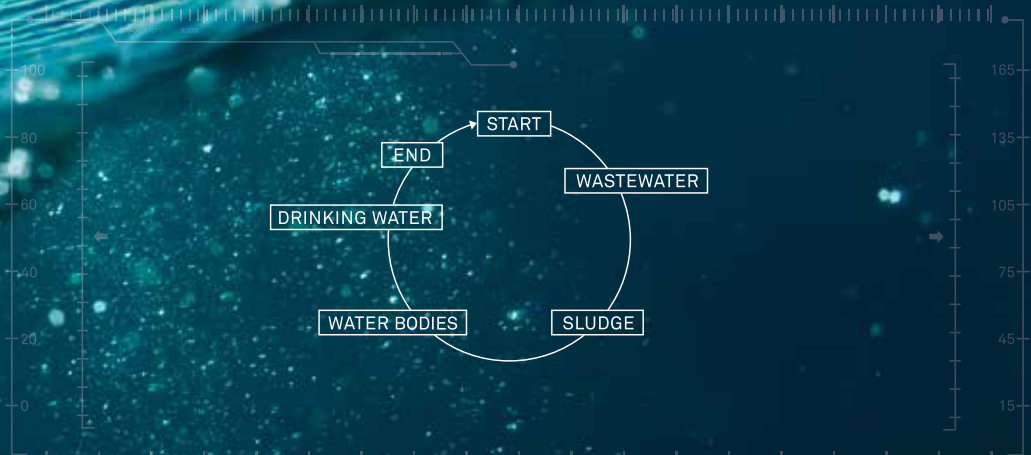
- John Weninger, departing as Infrastructure Management Committee chair;
- Freda Leong, departing as Drinking Water Committee co-chair; and
- Michael Celli, departing as Young Professional Committee chair.

John, Freda and Michael will continue to participate in the committees and lend their expertise as general volunteers moving forward. 💧

If you are interested in joining a BCWWA Advisory Committee, please contact Jodi at jgarwood@bcwwa.org, or visit our website at www.bcwwa.org/about/committees for more information.

Are you on the move?

Have you or one of your colleagues changed positions, received a promotion or picked up an industry award? Send your People on the Move submission, along with a print-quality headshot, to watermark@bcwwa.org and be recognized in this section of *Watermark* magazine!



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BCWWA Events in June

This summer, stay up to date on trends in the water and wastewater industry, meet new people and build relationships within the industry!

Check out the following BCWWA events, happening this June! See the BCWWA event calendar at www.bcwwa.org/events for the latest information, dates and registration details.



BCWWA tour attendees at a Technical Tour in Sechelt, BC.

Technical Tour

The BCWWA Young Professional Committee is delighted to host a Technical Tour this summer in the Lower Mainland. These tours are designed to bring together students and young professionals with seasoned professionals to facilitate networking and knowledge-sharing in an experiential setting.

WaterBreak Webinar: 2016 BC Municipal Water Survey

The BCWWA runs monthly WaterBreak webinars – a series of online, professional development events focused on key issues of importance to our members and the broader water industry.

Join us for the June WaterBreak, discussing the results of the 2016 BC Municipal Water Survey. The survey was conducted by the Water Planning Lab at UBC's School of Community and Regional Planning and presents the most up to date analysis of local water use in BC, including pricing and metering coverage.



Cheryl Gomes with BCWWA staff members Michelle Trent and Ashifa Dhanani getting ready for February's WaterBreak Webinar presentation.

Workshop: Risk Management – legal, financial and operational risk

The BCWWA Infrastructure Management and Risk & Resilience Advisory Committees are pleased to host a one-day workshop focused on risk management for water and wastewater facilities.

Workshop speakers will examine common legal, financial and operational risks and how each can be mitigated through a strong infrastructure management program. 💧



Jeremy Braacx, BCWWA Cross Connection Control (CCC) Manager, presenting at a CCC Workshop.

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Celebrate BC Water Week from May 1-7, 2016

Show your love for BC water and pledge to **Protect**,
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systems! Visit valueofwater.ca for details.



Celebrate BC Water Week

FROM MAY 1 – 7, 2016

Each year, the BCWWA partners with Ipsos Reid to measure public attitudes in BC about water. Our most recent survey revealed that as many as 61% of British Columbians don't know where their tap water comes from, and 73% don't know where their wastewater goes.

We often take for granted the natural resources as well as the pipes, pumps and people that deliver safe and reliable water and wastewater services to our home and businesses each day. Join us in celebrating the value of our water resources and systems during BC Water Week from May 1-7, 2016!

Tap water: There is no substitute

Tap water protects our health, environment and quality of life. We all rely on clean, safe water to drink and wash, and to flush waste from our homes and businesses. Our water systems deliver fire protection and support our economy. Because of tap water, we stay hydrated, healthy and happy.

Investment in water systems protects our health, environment and quality of life

While water is provided by nature, there is a real cost for the pipes, pumps, equipment, and people who ensure it is safely delivered to our taps and returned to the environment every day. Aging infrastructure, population growth, strengthened regulations, seismic hazards, and climate change are driving the need to invest in upgrades and renewal of our water systems. If we aren't willing to pay for these essential systems, our health and prosperity will be at risk.

Show your love for BC water!

We are all stewards of our water systems, for this generation and the next. Help protect our source waters from pollution, practice water conservation, and encourage our elected officials to make water and sewer system renewal a top priority for community investment. Visit valueofwater.ca to take the pledge to **Protect**, **Conserve** and **Support** our water resources and systems. 💧

Thank you to our supporters



Image credit: Comox Valley Regional District celebrating BC Water Week

GET INVOLVED

- Pledge to Protect, Conserve and Support our water resources and systems before May 7 and you will be entered into a draw for a chance to win 1 of 3 prize packages from Tourism Whistler!
- Sign up to receive regular email updates on BC Water Week activities and resources by contacting Jodi at jgarwood@bcwwa.org.
- Host an event or schedule a group tour of your local watershed or treatment facility in your community and upload the details to the event calendar at valueofwater.ca.
- Sign the pledges to Protect, Conserve and Support our water resources and systems at valueofwater.ca and encourage your family, friends and community to do the same.
- Follow us on Facebook ([ValueofWaterCA](https://www.facebook.com/ValueofWaterCA)) and Twitter ([@valueofwaterCA](https://twitter.com/valueofwaterCA)) and promote BC Water Week through your own organization's website and social media channels.
- Download and share the educational children's activities available at the valueofwater.ca.
- Participate in the Best of the Best Tap Water Taste Test on May 3 at the BCWWA Annual Conference & Trade Show.

To learn more, visit valueofwater.ca or email Jodi at jgarwood@bcwwa.org.

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Workforce challenges and opportunities facing the water sector

BY JODI GARWOOD, TECHNICAL COMMUNICATION SPECIALIST, BCWWA

At any moment of the day in British Columbia, clean water flows from our taps and wastewater disappears seamlessly from our drains and toilets. We give little thought to the complex system of treatment, distribution and collection that make this possible, nor to the people who are responsible for these critical systems. Yet, the water and wastewater workforce plays a key role in safeguarding public health and the environment by taking care of our water and wastewater and making sure that our systems are always available and safe to use.

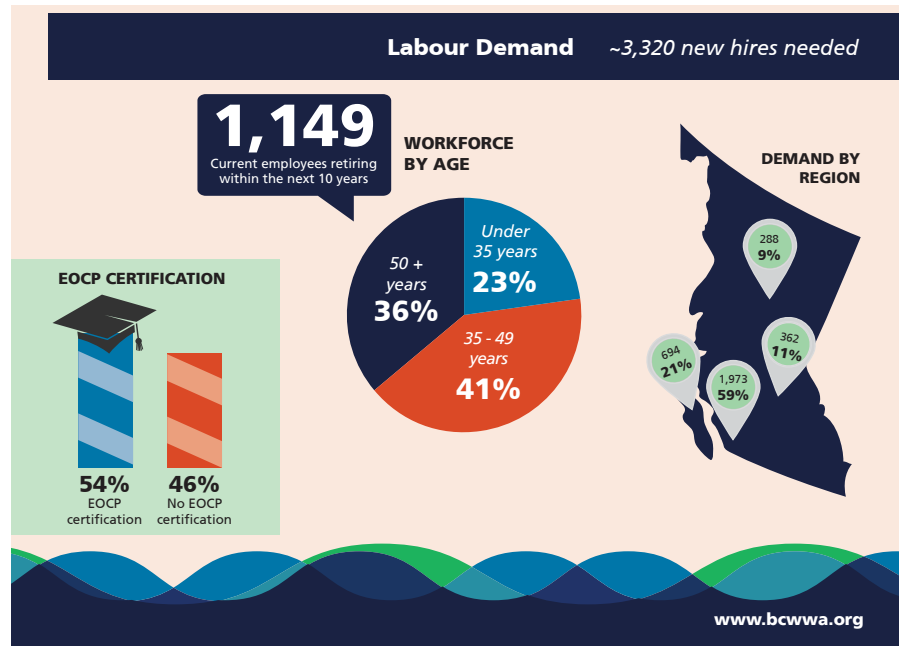
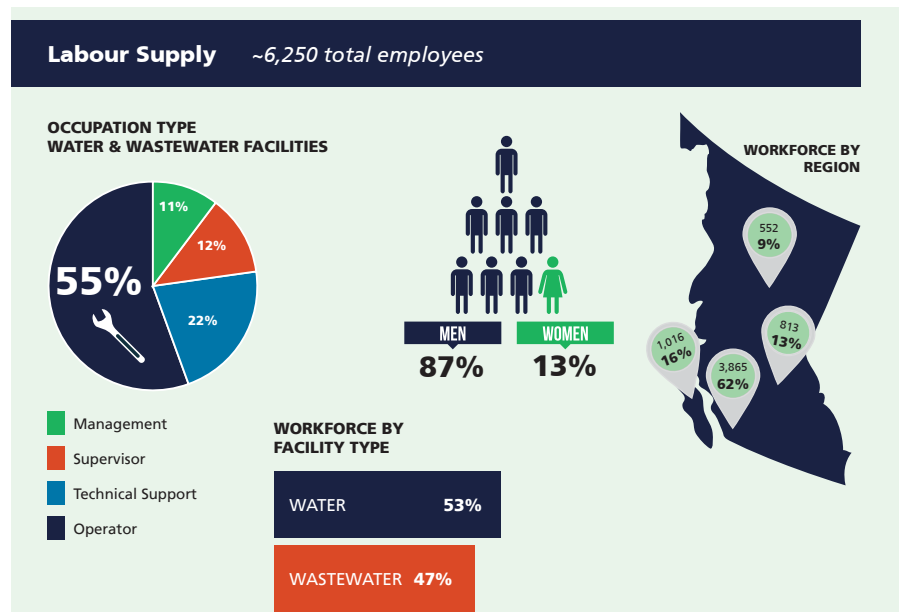
Despite the importance of the sector, there has been a lack of reliable, BC-specific data to document and understand the dynamics of the water and wastewater workforce. To address this gap, the BC Water & Waste Association (BCWWA) and the Environmental Operators Certification Program (EOCP) have developed the *BC Water & Wastewater Workforce Sector Profile* (the Executive Summary is enclosed with this issue of *Watermark* magazine).

The research examines existing labour market information in addition to BC-specific sector data provided through surveys and interviews as well as focus group with employers, training organizations, regulators, and accreditation institutions. The result is a comprehensive profile that will help ensure there is a sustainable, competent workforce that is capable of protecting public health and the environment, now and in the future.

KEY FINDINGS

Workforce Demographics

Estimates based on survey results show that the water and wastewater sector workforce is comprised of 6,247 total employees. Of the total water sector workforce, the majority of employees are employed as operators (55.4%) or technical support staff (21.7%). The workforce is nearly evenly distributed between water (53.1%) and wastewater (46.9%) facilities.



Workforce demographic findings indicate that the sector is predominantly comprised of men who are 35 years of age and older. The sector has not attracted younger workers in recent years; only 23% of the workforce is between 19 and 35 years of age, compared to 33% of the BC population. The majority of the water sector

workforce works in the Mainland/Southwest (61.9%) region of the province, followed by Vancouver Island/Coast (16.3%), the Interior (13.0%), and Northern BC (8.8%).

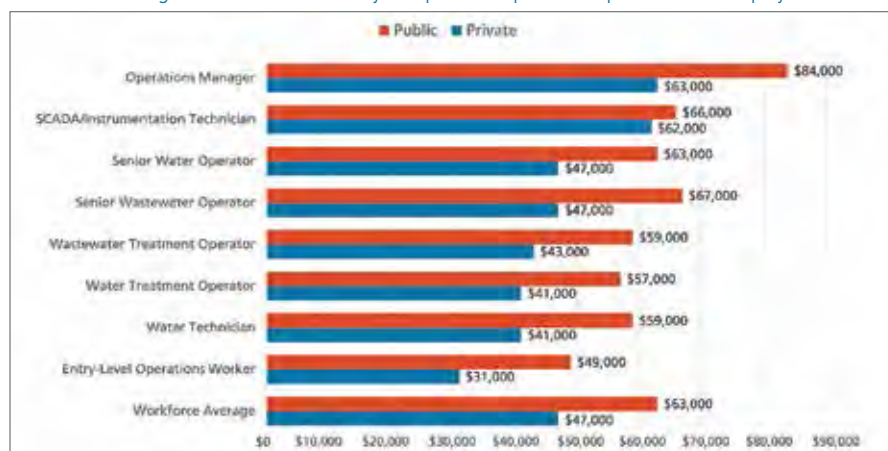
EOCP certified employees account for 3,305 members (53%) of the sector's workforce and employees without EOCP certification account

for 2,972 members (47%) of the sector's workforce. Approximately one-third (34.2%) of employers reported that they provide additional compensation or a higher job rate maximum for positions that require either an EOCP designation or dual EOCP designation.

FIGURE 1: Workforce projections by occupation type



FIGURE 2: Average water sector salaries by occupation for public and private sector employers



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Hiring Needs

Projections show that the BC water and wastewater sector will see a turnover rate estimated at 29.7% of the workforce between 2015 and 2025. In addition, over one third of the water and wastewater workforce is over 50 years of age and more than half of this age group is expected to retire within the next 10 years, equivalent to approximately 1,150 employees. Yet, most employers do not have succession plans in place.

With turnover, retirements and sector growth, new hires for the water sector are anticipated to amount to a cumulative total of 3,319 by 2025 or about 53.1% of the estimated current total workforce. Operators will comprise the majority of new hires followed by technical support staff, supervisors, and management staff.

Salaries

Jobs in the water and wastewater sector are well paid and available in communities throughout BC. The average salary in the sector ranges from \$47,000 to \$63,000, with public facilities offering significantly higher wages in all roles.

Entry-level workers can earn wages starting at \$31,000 in private facilities and \$49,000 at public facilities. At the top end, Operations Managers, SCADA/Instrumentation Technician, and Senior Operators all have salaries over \$60,000.

Education Needs

Skills, education, certification levels, experience, and competencies currently need improvement and will assume great importance to meet workforce demand and supply over the next five years. Educational curriculum will need to be enhanced to ensure that the workforce can maintain technical skills, meet certification, and satisfy evolving industry requirements. These training needs include both technical and essential skills (e.g., communications, literacy, mathematics, collaboration, conflict resolution and computer skills).

For a detailed view of the BC Water and Wastewater Workforce Sector Profile, including key findings and conclusions, download the full report www.bcwwa.org/resources/research-reports.

[Click here to return to Table of Contents](#)

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WATER PRIORITIES

for sustainable and resilient communities in Canada

BY KATHRYN ROSS, CANADIAN WATER NETWORK

Western Canada faces many challenges when it comes to water, including urbanization, population growth, climate change, and competing demands for water use. BC has seen a marked increase in the frequency of extreme weather events, such as droughts, flooding and wildfires, that impact water supply, services and infrastructure. In the face of these challenges, resiliency and sustainability are integral for effective water management.

Water connects all facets of our lives in Canada, and managing it well can open the door to achieving resilient and sustainable communities. Effective water management –

including drinking water, wastewater, stormwater and urban watersheds – is critical for socio-economic prosperity and environmental health. Canadian Water Network (CWN), an innovation hub for water policy and practice and Canada's leading water research design and management organization, released the *2015 Canadian Municipal Water Priorities Report* [Priorities Report]. This report was led by the Canadian Municipal Water Consortium's leadership group, consisting of senior water executives from municipalities and utilities across Canada who play a crucial role in shaping the direction of municipal water research in Canada.

"Canada has the potential to be a global leader in water management, and that includes drinking water, wastewater, stormwater and urban watersheds," says Bernadette Conant, Chief Executive Officer of CWN. "The *2015 Canadian Municipal Water Priorities Report* highlights advancements in municipal water management in Canada, and provides insights into the most effective paths forward. Our hope is that the report will help water managers be better equipped to anticipate, respond and adapt to emerging challenges and trends, and ultimately make better-informed decisions on priorities and investments."



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The report highlights four priorities critical to water management decisions:

1. Integrated risk management;
2. Full cost recovery and financing;
3. Wastewater resource recovery and beneficial use of biosolids; and
4. Resiliency to storms and extreme weather.

Together, these four priorities provide a framework of key decision areas to consider in designing effective, integrated approaches for safe, reliable and sustainable water systems.

INTEGRATED RISK MANAGEMENT

Municipal water management is fundamentally an exercise in risk management and presents a unique set of challenges. The wide range of tasks for water managers include many risks, but they are not typically addressed within a coordinated and unified approach. Oftentimes, there are factors impacting risk planning and management that are outside of the direct control of municipal water managers. Issues such as flood control and source water protection may involve decisions made outside of local water utilities or management groups. They may also require a risk management approach that can involve other municipal departments and public and private sector groups who operate beyond municipal boundaries.

Solutions presented in the Priorities Report highlight how essential it is that integrated risk

management strategies include the development of a common understanding and language among those identifying and managing the risks. By broadening proactive risk management to all areas of municipal water management and supporting a more integrated approach, water managers will have a better understanding of risks that can affect multiple water systems and will be able to effectively match mitigation efforts to minimize risks appropriately.

FULL COST RECOVERY AND FINANCING

The majority of Canadians have access to an abundant supply of safe and reliable drinking water, effective removal and treatment of wastes, and protection from floods or extreme weather. The largely hidden nature of what goes into ensuring successful delivery and management of community water supplies has resulted in difficulties ensuring that full costs of water management are both recognized and financed. Delivering reliable municipal water services requires considerable expertise and expense, yet is often undervalued. Most water managers face significant challenges from historic underfunding that has led to backlogs of infrastructure repair or replacement, while simultaneously facing greater system demands. According to survey results of the *2016 Canadian Infrastructure Report Card*, the total value of core municipal

infrastructure assets is estimated at \$1.1 trillion, or about \$80,000 per household. This number includes infrastructure needed for municipal water and wastewater services. In the 2015 report, *Are Our Water Systems at Risk?*, the BC Water & Waste Association and Urban Systems note that communities in BC alone will require at least \$13 billion to address shortfalls in current reserves to replace aging water and wastewater infrastructure. With aging infrastructure needing maintenance, repairs and replacements, full cost recovery and financing of our water systems has never been so important to a resilient and sustainable community.

Municipal revenues for water management have historically been secured through a combination of development charges, customer fees for delivered water and a draw on the local tax base. Canadian municipalities are moving to more sophisticated fee structures that account for the full suite of costs and more effectively match revenues to costs incurred, while incenting desired behaviour.

There are several key insights for consideration to achieve full cost recovery and financing, including: accounting for the full suite of costs to provide services both now and in the future; implementing effective strategies and financial models that cover those costs in ways that are fiscally responsible and provide a good “fit”

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with the social and cultural realities of the communities being served; securing public and government support for investments by way of clear communication; and moving toward rate structures that include a combination of charges to more sustainably support the full costs and more explicitly reflect the different services such as wastewater, stormwater and fire service fees.

More robust and effective full cost recovery and financing models for water management can be achieved by assessing a broader inventory of options and approaches. Expanding and detailing the inventory will help Canadian cities have a better understanding of the different financing models being applied in Canada and their relative merits. Doing so will achieve more resilient and sustainable communities in Canada, both now and into the future.

Another area for long-term municipal planning and sustainability is viewing wastewater and treated municipal effluent as a resource.

WASTEWATER RESOURCE RECOVERY AND BENEFICIAL USE OF BIOSOLIDS

Wastewater is increasingly viewed as a resource with the potential to generate heat and energy, or act as an alternative source of water or valued chemicals. Wastewater can also be a source of nutrients such as nitrogen, phosphorus and carbon.

Biosolids, a nutrient-rich, major by-product of the wastewater treatment process is one example of wastewater resource recovery. In Canada, biosolids are regulated with provincial/territorial governments rather than the federal government, and Canadian wastewater plants produce more than 660,000 dry tonnes of biosolids per year. Municipalities and governments are looking for better resource recovery strategies as increasingly stringent wastewater treatment requirements and social and financial drivers push for improved operations efficiency. There is a need to sift through various discussions and debates to weigh the options and select approaches that provide a good fit with operational, financial and socio-economic realities. This demands a credible articulation of the state of evolving knowledge that addresses current questions and concerns about resource recovery and biosolids. It is particularly true in relation to knowledge about the potential environmental and public health implications of contaminants associated with wastewater discharges or land application of biosolids.

Additional insights on wastewater resource recovery and beneficial use of biosolids from the Priorities Report touch on a national research strategy for water and wastewater, developed in response to the request from the Canadian Council of Ministers of the Environment.

These insights highlight a desire for improved understanding and articulation of: a) the state of the knowledge for nutrient recovery from wastewater, and b) the fate and implications of trace substances in wastewater for recovery options. Another key consideration currently impacting choices about resource recovery options is assessing the potential environmental and public health implications of contaminants resulting from wastewater discharges or land application of biosolids.

Capitalizing on the best opportunities will depend on understanding which solutions make the most sense, not only for potential resource recovery, but in terms of risks, costs, operations and public support. Finding the right fit between technology, community needs and management requires consideration of how options address overall community goals, coupled with trusted knowledge sources to inform considerations of safety and benefits.

Identifying the possibilities and implications of wastewater resource recovery and beneficial use of biosolids is a key priority for municipal water managers. The next priority as identified by the Priorities Report is about determining what is practical and achievable for making municipal water systems more resilient to storms and extreme weather.

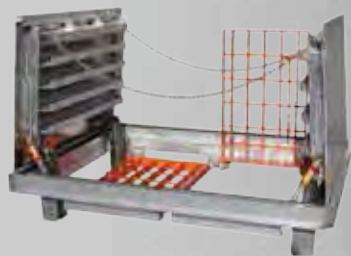
RESILIENCY TO STORMS AND EXTREME WEATHER

Most communities in Canada are recognizing that it is not *if*, but *when* and *how often* events like major storms, droughts or extreme temperatures will impact them. Storms and extreme weather result in costly damages to property and infrastructure and can have impacts on environmental and public health. Last summer, hot and dry conditions in BC led to water restrictions being imposed across the province. According to the British Columbia Wildfire Service, the 2015 wildfire season was one of the worst in the past decade, with over 1,800 wildfires. Wildfires are an extreme weather event that can lead to potential long-term impacts on drinking water supplies that affect water quality and stream health.

Water managers are moving toward improved long-term planning models that include a combination of innovative green and grey infrastructure approaches and multi-level strategies to reduce the impacts of severe weather. Use of predictive models based on historic conditions can be unreliable, therefore improved tools to predict intensity, duration and frequency (IDF) of storms are continually being improved. A CWN-funded research project led by Dr. Simonovic of Western University, focused on updating IDF curves under a changing climate and developed a web-based publicly

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accessible tool. Using GIS, a user can carry out statistical analysis on historical data, and generate and verify possible future change based on a methodology using a combination of global climate modeling outputs and locally observed weather data. In addition to these predictive models, water managers are looking to incorporate elements of resiliency to extreme or unexpected conditions for their water systems, as well as ensuring they can better mitigate risks associated with extreme weather.

Storm events can also cause particular concern for public health when they overload systems and untreated water from combined or sanitary sewers is discharged into a watershed that serves as a municipal source water or recreation area. In response to these storm events, there are many proactive water managers that are implementing strategies and master plans that include public outreach to improve preparedness, response and outcomes to extreme weather. This also includes a combination of innovative grey (dams, pipes, sewers, holding tanks) and green (wetlands, bioswales, rain gardens) infrastructure approaches to reduce the impacts of severe weather.

The Priorities Report notes that although wastewater costs currently dominate infrastructure financing challenges in Canada, costs related to stormwater are already significant and likely to increase. Water managers recognize storms and extreme weather as a major challenge for water management that require better information to support decision-making.

CONCLUSION

As issues of resiliency and liveability come into focus for planning and policy-making in Canadian communities, water managers are working to increase the sustainability of municipal water systems. Vitally important investments in water infrastructure maintain healthy communities and local economies that can meet the diverse demands of a growing and increasingly urbanized population; one which is facing unprecedented change and uncertainty on many fronts, including the impacts of a changing climate.

"In the face of ongoing change and the need for resiliency, approaches to municipal water management need to move beyond the 'typical' or 'average'," says Dr. Bu Lam, manager of municipal programs at Canadian Water Network. "Conferences like Blue Cities: Water Resiliency for the New Normal and the BCWWA Annual Conference & Trade Show are prime examples of how resiliency and sustainability are top of mind as key decision-making areas for municipalities today and into the future."

The four national priorities set out in the 2015 *Canadian Municipal Water Priorities Report* reaffirm the importance of effective management of a resource as integral as water. By doing so,

this will lead to strengthening Canada's economy, ecosystems and the health of communities – which is the foundation of achieving resilient and sustainable blue cities.

ABOUT THE AUTHOR



Kathryn Ross is a communications professional with Canadian Water Network. Canadian Water Network is Canada's leading water research design and management organization, and an innovation hub for water policy and practice. For more information, please visit www.cwn-rce.ca.



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Feast AND Famine, Flood AND Drought:

Solutions and tools for building water-resilient communities

By Kim Stephens, M.Eng., P.Eng.,
Executive Director, Partnership for Water Sustainability in BC

In collaboration with: Ted van der Gulik, P.Eng., President, Partnership for Water Sustainability in BC; Eric Bonham, P.Eng., Founding Member, Partnership for Water Sustainability in BC; and Bob Sandford, author and EPCOR Chair for Water and Climate Security at the United Nations University Institute

Western North America may be crossing an invisible threshold into a different hydro-meteorological regime. Annual volumes of water entering and exiting regions are not necessarily changing. Instead, what is changing is how and when water arrives and leaves – its flood and drought! In December 2015, the *Feast AND Famine* Workshop addressed this over-arching question: What should we expect and what can we do to build “water-resilient communities”?

Held in Richmond, BC, and co-hosted by the Partnership for Water Sustainability and the Irrigation Industry Association, *Feast AND Famine* showcased solutions and tools to address risk and build resiliency. A decade earlier, the 2003 “teachable year” had set in motion water sustainability processes in BC, guided by a vision to develop solutions and tools that would help communities manage risk and build resiliency in response to a changing climate.

WETTER, WARMER WINTERS; LONGER, DRIER SUMMERS

The weather in 2015 has impacted how the public views the BC climate and their understanding of how it is changing. There is now growing awareness that the summer dry season has extended on both ends. BC communities can no longer count on a predictable snowpack and reliable precipitation to maintain a healthy water balance in their watersheds. 2015 is a teachable year, the first since 2003. This creates a window of opportunity to implement **solutions and tools** developed in BC.

What Happened to the Water Balance?

Bob Sandford, internationally known author, water champion and keynote speaker, provided this big picture context at the *Feast AND Famine Workshop*: “The drought that extended this past winter, spring and summer from Vancouver Island to Manitoba

and from Mexico to the Yukon is an indicator that Western North America may be crossing an invisible threshold into a different hydro-meteorological regime. After a period of relative hydro-climatic stability, changes in the composition of the Earth’s atmosphere have resulted in the acceleration of the global hydrologic cycle with huge implications. We can expect deeper, more persistent drought punctuated by flooding.”

A Solution: Design with Nature

Adaptation to a changing climate was a unifying theme. Designed to spark a conversation that would reverberate after the workshop, *Feast AND Famine* shared a vision for “designing with nature” to restore hydrologic integrity and maintain the seasonal “water balance.” Attendees were introduced to solutions and tools that can help communities achieve

water resiliency. Both the urban and agricultural perspectives were represented.

The workshop program comprised four cascading modules – from high-level visioning to ground-level applications. Each module was delivered by a team of two presenters.

A Teachable Moment

“The program was high-energy. Presentations were dynamic. Everyone is passionate about what they do. The collective enthusiasm of the presentation team energized those who attended. It was a memorable day,” reports Mike Tanner, Workshop Chair. The event attracted an audience totaling 115. It also attracted media attention, resulting in front-page headline stories in both of BC’s major daily newspapers. This led to further radio and TV coverage when the 2015 drought was voted BC’s top news story of the year in an online poll.

WHAT HAPPENS ON THE LAND MATTERS

Each module had an identified learning objective. For Module A, the objective was that participants would understand that accepting risk opens the door to creativity and results in innovation. If we all know the context for action, then together we can change the culture and instill a new ethic. And if we achieve the latter, we will create a legacy.

In Module A, Kim Stephens and Bob Sandford provided the BC and global contexts, respectively and then interacted with the audience in a town-hall style “sharing & learning” session. The energy this approach created set the tone for the workshop day. Bob Sandford elaborated on the value of understanding the history of water policy and management in California. He also made the case for “restorative development.” Kim Stephens introduced three provincial game-changers that enable restorative development in BC.

Game-Changers Enable Action

During the late 1960s, BC began its multi-faceted and ongoing journey towards sustainability. It has taken the past decade to begin implementing a policy, program and regulatory framework that makes water-resilient communities achievable. Milestone years in this journey are 2003 (“the teachable year”), 2008 (“the call to action”) and 2014 (“game-changers”). A unifying theme for these three milestone years is design with nature and build greener communities.

The workshop unveiled the branding graphic for the three game-changers, namely: Develop with Care 2014, the *Water Sustainability Act*, and Asset Management for Sustainable Service Delivery: A BC Framework. As illustrated by Figure 1, the three are a mutually reinforcing package. The three enable necessary actions by local governments to protect and/or restore the natural pathways by which rainfall reaches streams. This would achieve the goal of redistributing the seasonal water balance to restore hydrologic integrity in urban areas.

“We had no idea until recently of how much influence the hydrological cycle has on our day to day lives or on the broader conditions that define the distribution and diversity of life on this planet. It has been very difficult even for experts to grasp the full extent of what the loss of relative hydrological stability means,” stated Bob Sandford.

HOW ARE LOCAL GOVERNMENTS RESPONDING?

The Cowichan Valley Regional District and District of North Vancouver are incubators for water balance approaches at the regional and municipal scales, respectively. In Module B, Keith Lawrence and Richard Boase showcased solutions that their respective organizations are pioneering.

Changing How Decisions Are Made

“Recurring region-wide consequences of water-related challenges have prompted regional action to develop governance structures and processes to make the connections between high-level decision making and actions on the ground. The *Regional Surface and Ground Water Management and Governance Study* identified co-governance with First Nations as a primary condition for success in managing regional water resources,” stated Keith Lawrence. “It is proposed to apply whole watershed thinking and follow a risk-based approach to decision-making and management across the region.”

Climate Change Adaptation Strategy

Richard Boase presented the first public unveiling of North Vancouver’s work-in-progress Climate Change Adaptation Strategy. He explained how the District had applied a five-step BARC process (*Building Adaptive & Resilient Communities*).

The Shifting Baseline Syndrome concept, published by Dr. Daniel Pauly of UBC in 1995, provides a frame-of-reference for the strategy. “Dr. Pauly observed that ecological standards are lowered almost imperceptibly with each new generation. This results from lack of knowledge of the historical condition of the environment. The existing condition is accepted as the normal condition. It is so important that we recognize this syndrome, and that each of us take steps and measures to avoid the shifting baseline.”

WILL THERE BE SUFFICIENT WATER FOR AGRICULTURE?

In Module C, Ted van der Gulik and John ter Borg explained the complexities of water supply for agricultural lands in the Fraser River delta, what impacts sea level rise may have, and how climate change will affect water demand to grow our food.

How Will the “Salinity Wedge” Move Upriver?

Many local governments draw water from the Fraser and distribute it to farmers through a network of channels and ditches. For agricultural lands near the estuary, however, this water supply may be jeopardized by a combination of two factors: sea level rise which extends the reach of the salinity wedge upriver; and lower flows in the Fraser during the summer months.

Replacement of the George Massey Tunnel (with a bridge crossing) will allow for dredging of the river channel to accommodate deeper draft ships, which would likely result in movement of the salinity wedge during lower river flow and impact agricultural water supply.

What about Food Security?

“Agriculture is a large fresh water user and the demand for water will only increase as summers get longer, hotter and drier,” stated Ted van der Gulik. “BC needs 215,000 hectares of irrigated agriculture to feed our current population. The approximately 28,000 irrigated hectares in

Figure 1: Game-Changers

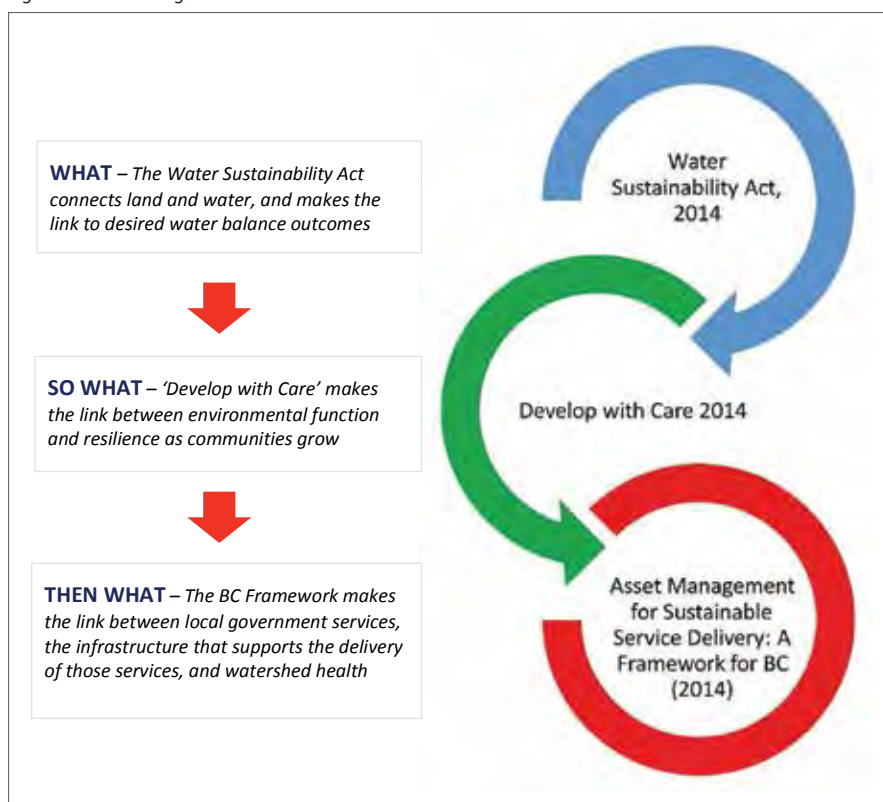
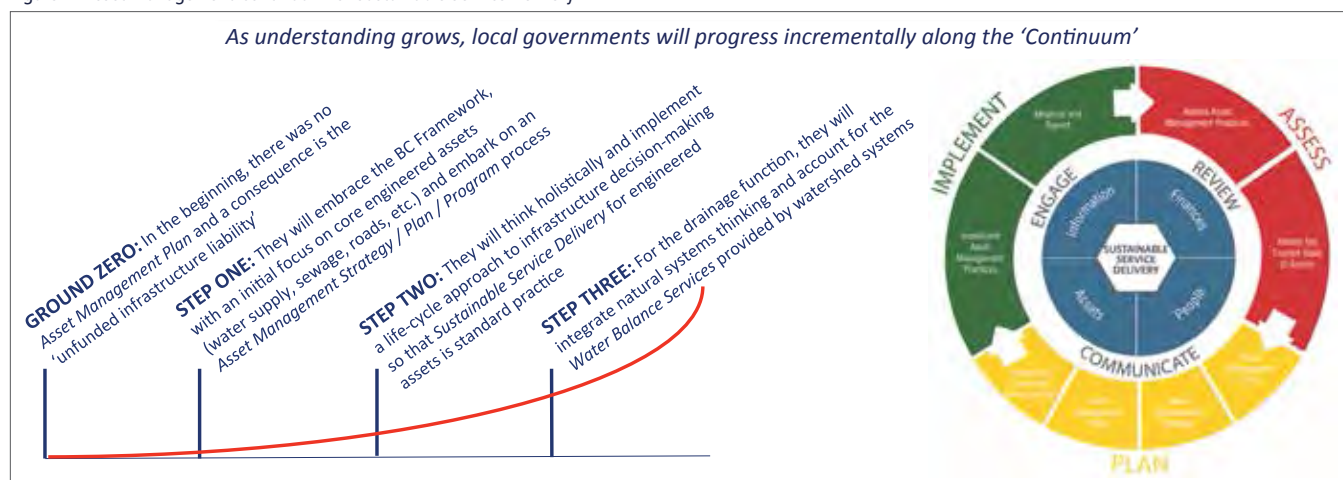


Figure 2: Asset Management Continuum for Sustainable Service Delivery



the Lower Mainland (13,000 in Metro Vancouver plus 15,000 in the eastern Fraser Valley) compares with about 20,000 in the Okanagan Valley. With careful planning, the irrigated area in the Lower Mainland could be increased to 69,000 hectares at buildout. From both the food security and resiliency perspectives, this underscores the strategic value of agricultural land in the Fraser Valley."

Ted's perspective provided the Vancouver Sun with a lead-in for its headline story: "I support market gardens. They're good. It is great to see residents grow their own food in urban areas. However, market gardens do not provide a significant source of food for our provincial needs — don't sell them as being a significant part of the provincial food security plan."

SUSTAINABLE WATERSHED SYSTEMS, THROUGH ASSET MANAGEMENT

In Module D, presentations by Glen Brown (Union of BC Municipalities) and Kirby Ell (Irrigation Industry Association) allowed the audience to leave the workshop with food for thought on practical measures that accumulate to make a big difference.

Kirby Ell explained the new High Efficiency Irrigation Standard (HEIS), an online assessment tool. Landscape irrigation can use up to 50% of the summertime domestic water demand, yet is rarely more than 50% efficient. Improving irrigation system efficiency can significantly reduce water demand, stretch water supplies and help protect watersheds.

Watersheds as Infrastructure Assets

Glen Brown introduced the Asset Management Continuum for Sustainable Service Delivery (Figure 2). "Implementation of asset management along with the associated evolution of local government thinking is a continuous process, not a discrete task. We needed a way to illustrate this diagrammatically. This led us to the concept of a continuum," he explained. "The continuum bridges two pieces. One piece is recognition that the asset management process is founded

on an incremental approach. The other piece is integration of natural capital, natural assets and watershed systems thinking."

A watershed is an integrated system. The natural pathways by which rainfall reaches streams are infrastructure assets and those pathways provide water balance services. This is why it is necessary to protect and/or restore hydrologic integrity in urban areas to preserve or redistribute the seasonal water balance.

LOOKING INTO THE FUTURE

"The sub-title for the *Feast AND Famine Workshop* could very well be LEADERSHIP, PROCESS, CREATIVITY and the ROLE OF CHANGE AGENTS, for this is what we heard. People, in each of their areas of expertise, are making change on the ground," stated Eric Bonham when he provided a rousing finish to the day with his reflections on what he had heard and observed.

Innovative Strategies Required Now

So what were the fundamental lessons garnered from *Feast AND Famine*, and how can we apply those lessons to the future planning of our urban and agriculture communities?

Bob Sandford set the context with his key observation that hydro-climatic stability, once fairly dependent, is no longer the case. Innovative strategies that address the challenge of drought or flood are now required. This reality has an immediate impact on future water, energy and food security.

Towards Consensus, Commitment and Collaboration

Given this context, Eric Bonham noted that future planners, engineers, politicians, and citizens alike will be called upon to demonstrate both vision and pragmatism, and be able to frame the issue of achieving water-resiliency in communities against the backdrop of an unpredictable water cycle. This in turn demands the honing of a further skill; that of working together towards consensus, commitment and collaboration.

Such collaboration is essential and must cross all political and community boundaries, for climate change is no respecter of such creations. This will not come easy and will call for cooperation on a level heretofore not considered necessary or even possible, which brings to mind that old adage "united we stand, divided we fall."

Think like a Watershed

Water is truly the connector of all activities on earth, whether it is the economy, ecology or the well-being of human and non-human alike. The hydraulic practitioners of the future will be encouraged to "think like a watershed," recognizing the invaluable contribution of natural systems.

In summary, think creatively as well as collaboratively and search for "outside the pipe" solutions to the pending changes anticipated from climate change. Albert Einstein had his finger on the pulse when he noted: "No problem can be solved from the same consciousness that created it. We have to learn to see the world anew."

To learn more about the workshop, visit www.waterbucket.ca/cfa/category/on_the_ground_changes-in-british-columbia/2015-feast-and-famine-workshop/

ABOUT THE AUTHORS



KIM STEPHENS: His four decades of experience as an engineer-planner cover the spectrum of water resource and infrastructure engineering issues.

Provincially, he has had a leadership role in a series of initiatives related to water sustainability, watershed health, rainwater management and green infrastructure. In 2009, Kim received a *Premier's Award for Excellence and Innovation*. He has been invited to speak on 'the BC experience' and make keynote presentations at forums throughout North America, as well as in Australia. In 2015, he was invited by US Senator Patrick Leahy of Vermont to provide inspirational remarks at the 2nd Leahy Environmental Summit.



Bob Sandford speaking at the Feast AND Famine workshop.



Richard Boase speaking at the Feast AND Famine workshop.



TED VAN DER GULIK: When he retired from government in 2014, he was the Senior Engineer in the Ministry of Agriculture. Ted built an international reputation for his work in agricultural water resource management. His contributions go beyond agriculture and encompass integrated watershed planning initiatives. During his career, he led numerous water projects that had an impact on individual farms, entire communities and watersheds. The many guides and manuals he wrote are used locally and around the world. Ted's accomplishments include three *Premier's Awards of Excellence*: Water Balance Model (2009); Agriculture Water Demand Model (2010); and Legacy (2014).



ERIC BONHAM: He is a civil engineer with a political science degree and 50-plus years of water-centric experience. He is a former Director in two provincial ministries – Environment and Municipal Affairs. A keen believer in community stewardship, he is a Director of the BC Lake Stewardship Society and was actively involved in park creation on Vancouver Island. He was named an Honorary Citizen of Victoria for his contribution to the community and has received awards from a number of organizations for his contribution to water management issues in BC.



BOB SANDFORD: He is the co-author of the UN *Water in the World We Want* report on post-2015 global sustainable development goals relating to water. He is committed to translating scientific research outcomes into language decision-makers can use to craft timely and meaningful public policy and to bringing international examples to bear on local water issues. He co-authored *Flood Forecast: Climate Risk & Resilience in Canada* (2014). His latest book is titled *Storm Warning: Water & Climate Security in a Changing Canada* (2015).

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EMERGENCY MANAGEMENT:

Prevention and mitigation

By Bruce Hertz, Vice President, Business Development,
ERMC Global; Member of the BCWWA Risk & Resilience
Technical Advisory Committee

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In the fields of water and wastewater, the principles of emergency management apply. Cases such as the Walkerton tragedy are stark reminders that our work can never been taken for granted. Today, Flint, Michigan in the US is still using bottled water due to lead contamination. Regardless of cause, you can be assured that the emergency management program in that water utility and community is running flat out!

To understand how emergency management relates to the water and wastewater industries, it is important to recognize the key elements of emergency management:

- Prevention/Mitigation – understanding hazards and minimizing their impact and likelihood;
- Preparedness – being ready, planning, training and exercising, just in case;
- Response – alerting, mobilizing resources and managing through an emergency; and
- Recovery – getting back to “normal” operations and integrating lessons learned as part of continuous improvement.

The elements of prevention and mitigation provide perhaps the most benefit to our emergency management efforts, with the least amount of recognition. The investment in these elements can be difficult to justify as “measuring” the benefit of a non-impact or a non-event can be hard to define.

The most critical element of mitigation is completing a thorough, “all hazards” risk assessment. Regardless if you are a dam owner, a fresh water supplier or a waste treatment service provider, it is important to understand exactly what hazards can impact you, your customers, your community, their likelihood of occurring, and potential impact.

Risk in emergency management can be defined as the likelihood of a hazard occurring,

multiplied by the impact of that hazard.

Earthquakes are a great example – the impact of a Richter scale 7 earthquake in Prince George may not be the same as in Vancouver. The likelihood may be greater in Vancouver than in the interior of the province.

When preparing a risk assessment, clear and defined criteria for analyzing likelihood and impact is essential. We often tell staff to repeat their assessment in the next year, and even though the people conducting the assessment may change, the criteria should stay the same. They may come up with different results, but with clear criteria they will be able to understand the results of the historical risk assessment and how theirs may differ.

Risks can and will vary and change year over year; the criteria needs to remain clear so that you can accurately assess them. In our field, hazards like severe weather events and infrastructure security are two threats that have definitely evolved and moved higher on our risk registers in the last 20 years. The same “impact” criteria may apply but the likelihood of the event and “level of impact” from these events can be greater than in the past.

Once you have your risks assessed and understood, you can then put in place strategies to mitigate or reduce the impact of those risks. We use different control measures to do this; for example, the speeding analogy:

- I don’t ever want a speeding ticket = I never exceed the speed limit = I will use cruise control to ensure I am always at, or below, the limit.
- I don’t think I will get a ticket = I will “only” go 10 kph over the limit because the police never bother me even though

I am "over." I will use cruise control (set higher) but I am alright with this level of risk. A radar detector is too much money and too much hassle for the level of risk that I am taking.

- I am alright getting a ticket; I only get one or two a year and that's alright for me = I will go up to 20 kph over the limit. I may use a radar detector, a license plate shield and cruise control but have assumed a much greater level of risk.
- I am alright getting a large ticket; the cost/demerit points don't bother me = I will greatly exceed the speed limit and a radar detector may alert me, but it will be too late. I am not mitigating my risks and am greatly increasing the likelihood of me getting pulled over and am prepared to fully accept the risk.

Once you understand your risks, you have certain things you can do:

- You can put in place new processes/ solutions/engineering to minimize the likelihood or impact of an event.
- You can transfer the risk – e.g., let another driver drive the car or perform that service – subcontract services to specialists.
- You can insure the risk – if it does happen, we are financially protected.
- You can assume the risk – you still need to provide water and waste water services. We need to be sure that our systems are working and that our testing protocols are prudent.

Most of us use all of the above in some way to manage our services. Key is that you have a clear understanding of the different risks that can impact you so that you can apply the above elements to address that risk.

When it comes to water and wastewater, we engineer our systems from construction, operations and maintenance to meet the first level. We never want to be in a position of accepting unmitigated risk. To help ensure this, we build redundancy into our systems. Even with these levels of controls, we have had incidents like Walkerton and Flint, Michigan, so vigilance and commitment to processes and understanding of risk is critical.

ABOUT THE AUTHOR



Bruce Hertz, B.Sc. MBA, joined ERM in 2005 and is the Vice President, Business Development. ERM is recognized as a leader in risk management,

emergency management and business continuity. Bruce has over 30 years of consulting, business management and risk management experience. 

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THE NEW PORT MANN WATER MAIN

ENSURING A SAFE, SECURE WATER SUPPLY TO
COMMUNITIES SOUTH OF THE FRASER RIVER

BY JOEL MELANSON AND ANTHONY FULLER

Metro Vancouver has supplied the region's drinking water since 1924, and provides clean, safe drinking water to over 2.4 million residents in the Lower Mainland. This water is distributed in partnership with local governments where Metro Vancouver's supply facilities and major water mains feed into local distributions systems, which in turn flow to homes and businesses.

In order to maintain the efficiency and reliability of our water supply system, Metro Vancouver constantly upgrades the region's water infrastructure.

The new Port Mann Water Main is a 1.5-metre-diameter welded steel water main connecting Metro Vancouver's Cape Horn Pump Stations in Coquitlam to the Whalley Reservoir in Surrey. It will span a length of over 6000 metres, and is designed to carry future peak flows of over 230 million litres per day to municipalities south of the Fraser River. This major infrastructure upgrade includes



*Steel workers installing structural reinforcing at the north shaft of the Port Mann Water Supply Tunnel
(Courtesy of Hatch Mott MacDonald)*

construction of the 1000-metre-long seismically designed Port Mann Water Supply Tunnel, which crosses the Fraser River at a depth of over 50 metres below the surface of the river.

Once complete, this new water main will twin the existing Port Mann Main, which was constructed in the mid-1970s, and will more than double Metro Vancouver's water distribution capacity along this corridor in order to meet future growth in the region south of the Fraser River. The design effort taken to account for the impacts of seismic activity is a vital and necessary step to ensure that this valuable piece of infrastructure is resilient enough to supply water to residents and businesses of Metro Vancouver in a post-earthquake environment.

PROJECT OVERVIEW

The project is divided into three sections: North, South and the Port Mann Water Supply Tunnel. The North section (Coquitlam) and the Water Supply Tunnel are currently under construction (**Figure 1**). The South section (Surrey) is in detailed design with construction scheduled between 2017 and 2019. This article primarily focuses on the process to incorporate seismic design into the North section of the water main, and to connect the Cape Horn Pump Stations to the new Port Mann Water Supply Tunnel in Coquitlam.

The design of the new main began in 2006 with the detailed design of the Port Mann Water Supply Tunnel. This included determining the optimal locations for the north and south shafts, and the ultimate depth of the tunnel under the Fraser River. This new tunnel replaces the existing portion of the Port Mann Main just below the bottom of Fraser River where the main is susceptible to river scour and seismic activity. The details of the new tunnel were determined based on factors including the new tunnel's ability to withstand a major earthquake, protection from anticipated river scour, and meeting future water demands. Construction of this portion of the new main began in 2011, and is scheduled for completion in late 2016.

With the location and depth of the tunnel determined, Metro Vancouver began the design process to choose the best routing option for the north section of the new Port Mann Main. A number of options were evaluated based on overall cost, constructability, environmental and archaeological impacts, as well as the feasibility of maintaining traffic during construction. The area through which all of the options extend is underlain by complex and highly varying soil conditions, which are the result of thousands of years of geological activity. This includes glaciation that carved out the slopes in the north, and the action of the Fraser River

Figure 1: Project Site for the New Port Mann Water Main



meandering across the flood plain over thousands of years building up sand, silt and clay. The low-lying areas eventually became fertile farmland, rich in organic matter.

Each of the route options also faced logistical challenges due to the presence of a number of major highways, including the Lougheed Highway, Mary Hill Bypass, the TransCanada Highway, and the new Port Mann Bridge. Canadian Pacific Railway's main line and spur lines bisect the area and intersect the route options just south of the Lougheed Highway. The Fraser River runs just to the south of the project site. Each of these features presented particular challenges to the design and installation of the main, including complex geological conditions and the seismicity of the region.

These challenges were addressed in the detailed design to ensure that the north portion of the water main could withstand a significant earthquake and convey water to the Port Mann Water Supply Tunnel. With our general understanding of the area's poor soil conditions, the established seismicity of the



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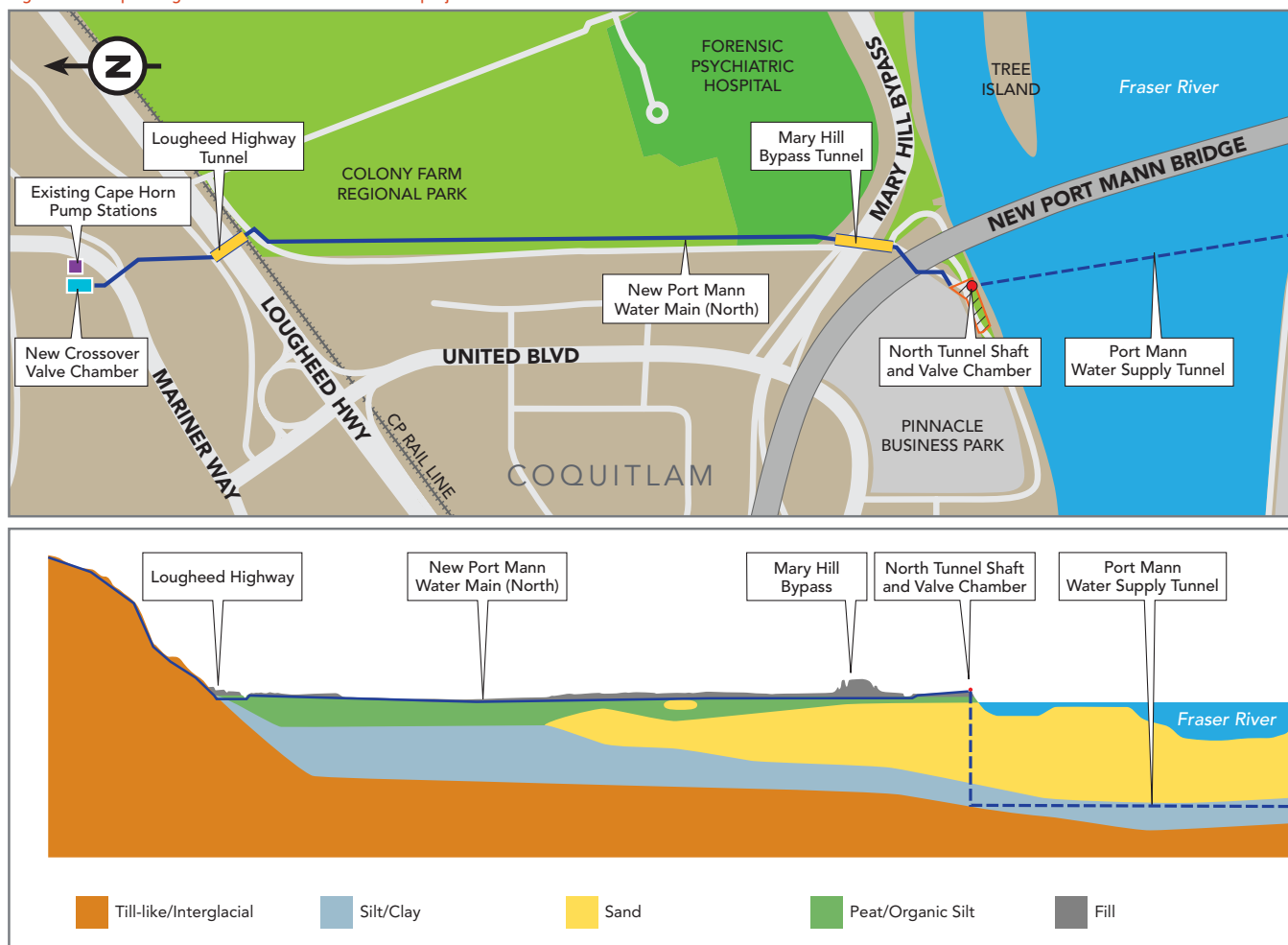
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Figure 2: A simplified geotechnical cross section of the project site



Lower Mainland, and the proximity of the new infrastructure to the Fraser River, the detailed design included a seismic analysis of the ground conditions and a structural analysis to assess the impacts of the anticipated seismically induced soil movements on the new water main.

DETAILED DESIGN

In 2013, Golder Associates Ltd. (Golder) was engaged to provide a geotechnical investigation to confirm the soil and groundwater conditions along the proposed water main alignment. The information collected was used in the civil and structural design of the water main, associated underground valve chambers, and the two short tunnels required to cross the adjacent Loughheed Highway and CP Rail line, and the Mary Hill Bypass. Golder also undertook environmental and archaeological assessments of the chosen alignment in order to assess and minimize the impacts of the pipe installation.

The other major component of the work performed by Golder was to predict how the soils in the project site would react to seismic ground shaking, and to assess the impacts of the soil movements on the new water main.

GEOTECHNICAL INVESTIGATION

The geotechnical investigation included drilling a series of test holes along the chosen alignment in order to obtain information on the soil and groundwater conditions. A number of technologies were utilized including sonic and auger drilling, electronic cone penetration tests (CPTs), and groundwater monitoring wells. Sonic boreholes are used to obtain soil cores, which provide a detailed picture of the soil layering, and augers are used to efficiently gather samples and to install groundwater monitoring wells. CPTs use electronic instruments that measure soil characteristics in-situ, and these characteristics were used to develop geotechnical engineering parameters for design.

The groundwater monitoring wells enable measurement of the water table depth and variation in the water level due to tidal influence near the Fraser River. Together, these techniques provided a clear picture of the sub-surface conditions that were invaluable in further design.

The results of the geotechnical investigation showed the site underlain by fill from historical development and overlain by natural sediments ranging from organic to dense till-like soils (Figure 2). The natural soils underlying the site vary significantly by location and depth. Underlying the upland area

north of the Loughheed Highway are dense strong soils laid down by glaciation. Within the low-lying Colony Farm, and extending from Loughheed Highway to the central part of the alignment, are extensive deposits of weak and compressible organic and fine-grained soils. The soils in the southern parts of Colony Farm (towards the river) consist mainly of liquefiable Fraser River silt and sand deposits. The central and southern parts of the site are underlain by old deposits of silt and clays, which are underlain by even older dense, glacial till-like soils.

The key challenges associated with the water main design and installation included:

- The presence of loose liquefiable sand deposits over the southern half of the project, extending into the Fraser River.
- Groundwater levels at or near the surface within the low-lying flood plain influenced by tides and river levels in proximity to the Fraser River.
- The need to cross Loughheed Highway, the CP Rail main and spur lines, and Mary Hill Bypass embankment.
- The presence of weak and compressible soils within the low-lying Colony Farm area.

TUNNELLING REQUIREMENTS

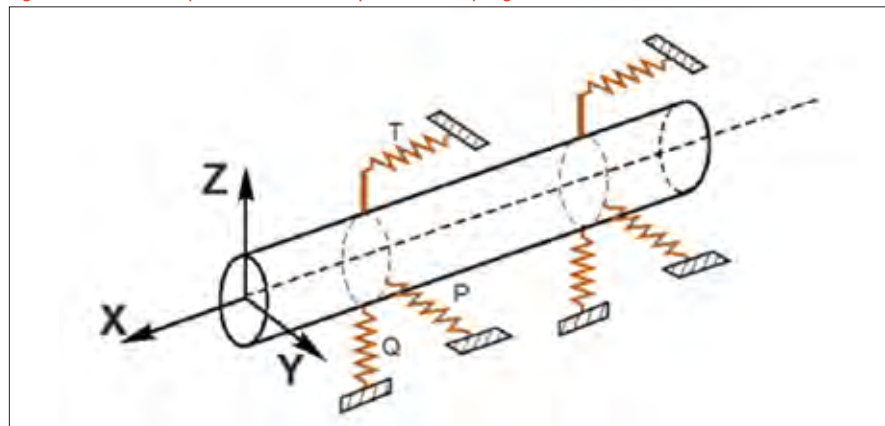
Lougheed Highway and the CP Rail tracks are the major transportation infrastructure in this area. Tunnelling was required to cross the CP Rail tracks and due to the relatively high impacts of an open-cut installation on traffic, the Lougheed Highway was included in this trenchless crossing. The 110-metre-long crossing extended through complex sub-surface conditions representing a transition between the dense, strong soils of the uplands, and weak compressible soils of the flood plain. The presence of existing surface and buried infrastructure further complicated the alignment and profile geometry. Therefore, the adopted construction approach was to install two reaches of pipe from a common centrally located drive shaft positioned in the eastbound shoulder of Lougheed Highway. This technique shortened the drive lengths so that more-conventional trenchless techniques such as pipe jacking or ramming could be used, permitting flexibility with the geometry of the tunnel to manoeuvre existing infrastructure.

Mary Hill Bypass is one of the major transportation routes connecting the eastern municipalities in the Lower Mainland to Vancouver. At the water main crossing, Mary Hill Bypass is supported on a 10-metre-high embankment forming the eastern approach to the overpass across United Blvd. Open-cut installation was not feasible under these conditions, and a tunnel crossing was selected as the most-reasonable approach. The soils underlying the embankment comprise Fraser River silt and sand deposits, and the water table is within a few metres of the surface. In order to maintain stability in these conditions, a micro-tunnelling technique was proposed to provide continuous support to the soils while maintaining the tunnel alignment. The total length of the tunnel is approximately 150 metres.

SEISMIC DESIGN CONSIDERATIONS

Seismic hazards in the Building Code of Canada are based upon probable earthquake ground motions having a two percent chance of being exceeded in 50 years (mean return period of 2,475 years). The building code is primarily applicable to the design of building and non-building structures. Metro Vancouver owns, operates and maintains the drinking water infrastructure for most Lower Mainland communities, and our water transmission system is considered an essential service. Because of this, Metro Vancouver has established a seismic design standard that has set minimum goal requirements for all new water infrastructure. Depending upon the importance of the facility, different levels of seismic hazard and target performance requirements may apply. These seismic hazard levels range from a ground-

Figure 3: Non-Linear Pipe with Non-Linear Equivalent Soil Springs



shaking event with a mean return period of 2,475 years to the Maximum Credible Earthquake (MCE) with a mean return period of 10,000 years.

This guideline applies to any specific portion of the distribution system based on the importance of each portion and the consequence of failure. Critical river crossings such as the Port Mann Water Supply Tunnel have the highest goal for seismic resiliency, namely to remain fully functional after the MCE (mean return period of 10,000 years). The goal for the land portions of this water main (both North and South sections) is for them to remain in service with only minimal disruptions after ground shaking with a mean return period of 2,475 years.

SEISMIC ANALYSIS RESULTS

As illustrated in Figure 1, the results of the ground investigation revealed the presence of loose, Fraser River sand sediments underlying the southern part of the overall site. The first step in analyzing the impacts of seismic activity is to estimate the anticipated soil movements of the design seismic event. The seismic analysis, which was performed using a computer model, indicates that these sediments are susceptible to liquefaction under the design earthquake event. Results indicate instability of the riverbank and lateral displacements in excess of three metres in the vicinity of the river bank under seismic shaking. Vertical settlements



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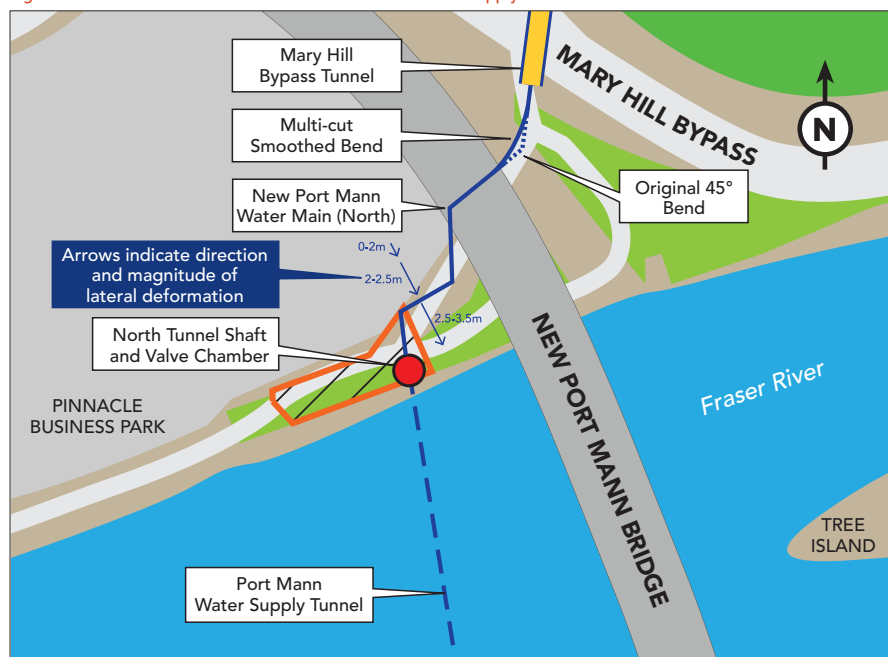
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Figure 4: Tie-in to the North Shaft of the Port Mann Water Supply Tunnel



following liquefaction of up to 200 to 400 mm are also indicated.

The second step, the pipe-soil interaction analysis, was conducted to evaluate the performance of the water main for the earthquake-induced ground displacements predicted in the seismic analysis. This structural analysis was performed by D.G. Honegger Consulting using a finite element computer model that accounted for non-linear soil restraint, plastic pipe response and geometric non-linearity from large deformation. The soil restraint around the pipe was simulated using discrete non-linear springs attached to nodes of a pipe element (Figure 3). The primary analysis results used to assess pipeline response are magnitude and distribution of the longitudinal tensile and compressive strains in the pipe.

As part of the project, acceptable limits on the longitudinal tensile and compressive strain

were defined for two levels of performance; continued operation and maintaining pressure integrity. The performance requirement of maintaining pressure integrity accepts the possibility that the pipeline will suffer some permanent deformation that will permit short-term operation but require repair for long-term operation. For the final configuration, the range of allowable compressive strain was defined as one percent for continued operation and three percent for maintaining pressure integrity, while the range of allowable tensile strain was defined as two percent for continued operation and four percent for maintaining pressure integrity.

PIPELINE ANALYSIS

The horizontal seismic ground displacement pattern used to assess pipeline response can generally be characterized as being

perpendicular to (moving towards) the bank of the Fraser River with a maximum of 3.3 metres at the tie-in to the Port Mann Water Supply Tunnel (Figure 4). In the initial analysis, longitudinal strains far above acceptable levels were computed in the 45-degree bend in the original pipeline alignment. From these results, it was evident that this unacceptable outcome was due largely to an unfavourable pipeline geometry relative to the direction of horizontal ground displacement. The north-south pipeline alignment, north of the 45-degree bend, essentially anchored the pipeline against axial displacement toward the river. Therefore, the lateral soil load on the pipeline south of the bend acted to force the bend open, producing high-bending strains.

A number of alterations to the pipeline configuration were evaluated analytically. Modifications were suggested that could reduce the longitudinal strains to a level 15 percent below the acceptance criteria for maintaining pressure integrity:

- The standard 45-degree bend south of the Mary Hill Bypass was replaced with a multi-cut mitre bend with an effective bend radius of 20 pipe diameters. Smoothing the bends in the vicinity of the 45-degree bend south of the Mary Hill Bypass allowed the bending to be spread over a much-greater length of pipeline.
- Increasing the pipe wall thickness from 15.9mm to 25.4mm in the vicinity where peak strains were encountered within approximately 450 metres from the Fraser River.
- Increasing the steel yield strength by 25 percent (248MPa to 310MPa), and changing the joint type from bell and spigot to butt-welded joints.

With the above modifications, the water main is expected to maintain pressure integrity for the design earthquake, which in this case means ground shaking with a mean return period of





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2,475 years. As noted above, it is expected that repairs will be necessary following the design earthquake to bring the system back to normal long-term operations.

TIE-IN TO THE PORT MANN WATER SUPPLY TUNNEL

Upon completion of the Port Mann Water Supply Tunnel and installation of the North section of the new water main, the two new pieces of infrastructure will be connected (tied-in) to each other. As previously noted, the Port Mann Water Supply Tunnel is considered critical infrastructure, and has been designed using our highest goal for seismic resiliency, which is to remain fully functional with no significant damage during the Maximum Credible Event. The tunnel was placed deep enough below the Fraser River to avoid soils susceptible to liquefaction, and the shafts on either side of the river were designed to remain functional during a seismic event.

This design feature of the Port Mann Water Supply Tunnel created a challenge for the North section of the water main in that it needed to move with the soil displacement, which is predicted to be approximately 3.3 metres in order to avoid high strains near the tie-in location and high loads on the intake structure.

Our tie-in point, the north shaft of the Port Mann Water Supply Tunnel, is designed to have smaller movements. In order to remain operational during the seismic event, the new water main design had to account for almost three metres of differential movement at this tie-in location.

The design team evaluated a number of options to manage this differential movement with the final design using a combination of restrained ball joints and flexible in-line expansion joints, which would allow the new water main to rotate and expand. These elements are designed to accommodate up to 3.9 metres of differential movement between the North section of the new water main and the north shaft of the Port Mann Water Supply Tunnel.

In summary, as we learn more about the impacts of seismic activity on our infrastructure, Metro Vancouver is ensuring that our world-class water distribution system is being designed using the latest tools and techniques. By implementing our seismic design standard, the design of the new Port Mann Main and Port Mann Water Supply Tunnel has taken into account liquefiable soils, and the associated settlement and lateral deformation caused by earthquakes. In addition to expanding our existing transmission system to accommodate future growth, this process is part of our goal to provide a reliable supply of safe, high-quality drinking water to local governments in Metro Vancouver.

ABOUT THE AUTHORS



Joel Melanson, M.A.Sc., P.Eng.

Joel Melanson is a Lead Senior Engineer in the Engineering and Construction Division of Metro Vancouver's Water Services Department. Over the past 10 years,

Joel has designed and constructed numerous large-diameter steel water mains throughout the Lower Mainland. Joel's passions lie in all things related to water, and prior to working with Metro Vancouver he worked as a Water Resources Engineer, consulting with both public and private industry in the United States and internationally.



Anthony Fuller, P.Eng.

Anthony Fuller is a practising geotechnical engineer and Associate in Golder Associates' Vancouver office,

and has over 18 years' experience in geotechnical engineering. Anthony received his Bachelor's and Master's in Civil Engineering from the University of British Columbia, and is the Geotechnical Engineer of Record for the North Section of the New Port Mann Main. 💧



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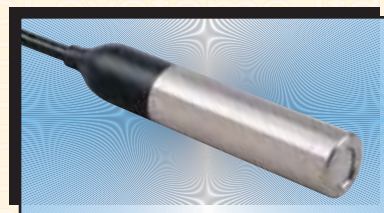
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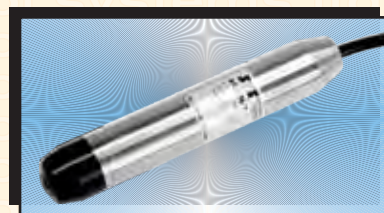
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Climate change has profound implications for agriculture. Our global food system is highly integrated, and in BC we rely heavily on production in other regions including California, South America, Australia and New Zealand to stock our supermarkets. Our reliance on local farms to supply our dietary needs has decreased steadily as the global food network has grown over the past 50 years. Suburbs and hayfields have largely replaced orchards and market gardens.

GLOBAL RISKS, LOCAL IMPACTS

Climate change and urban growth in California and other major growing regions may greatly reduce the availability of water-intensive fruits and vegetables for import to BC. Economic conditions that have recently favoured imported produce may turn in favour local production in coming decades. Although it is difficult to turn suburbs back into farms, since the early 1970s the Agricultural Land Reserve has slowed the loss of BC's farmland, and protected land in pasture can readily be converted to fruits, vegetables and other high-value crops. However, the same climate change that afflicts other growing regions will impact BC farms, necessitating careful water planning.

In 2012, an assessment of climate change-related risks and opportunities was conducted with the agriculture sector across BC under the *B.C. Agriculture & Food Climate Action Initiative*. The assessment evaluated the potential impacts of climate change on agricultural production in five key regions, and explored the sector's capacity to adapt. Based on the 2012 assessment, the *BC Agriculture & Climate Change Regional Adaptation Strategies* program has brought local governments and producers together to develop priority strategies and actions to facilitate agricultural adaptation. The intent of the project is to develop both clear actions suited to the specifics of the local context, and to encourage the integration of agricultural adaptation priorities into decision-making and planning across multiple agencies and organizations. A set of regional adaptation strategies for the Cowichan region was among the first to be developed under the project.

Based on projections by the Pacific Climate Impacts Consortium (PCIC), conditions for the Cowichan region in the 2050s may be more favourable in some respects for irrigated agriculture due to a longer and warmer growing season; however, water supplies will be adversely impacted by reduced high-elevation snowpack and increased frequency and intensity of droughts. Increased winter rainfall may also exacerbate existing lowland drainage and flooding issues.

One of the strategies identified for the Cowichan region was develop and pilot a process for water planning for individual farms. In 2013, a consulting team led by Kerr Wood Leidal Associates Ltd. (KWL) was retained by a project consortium consisting of the Cowichan Valley Regional District, Ministry of Agriculture, BC Agriculture and Food Climate Action Initiative and local producers to develop a toolkit to assist agricultural producers in the region with planning for future water needs. The work was funded by the Climate Action Initiative. KWL was subsequently selected to conduct pilot testing of the toolkit with nine producers in the region. The consulting team included Synetric Consulting (Hally Hofmeyr, P.Ag.), the Partnership for Water Sustainability (Ted van der Gulik, P.Eng.) and David Tattam.

FARM WATER PLANNING TOOLKIT

The objectives of the Integrated Farm Water Planning Pilot Project were to increase awareness of climate impacts on farm water management, develop practical tools producers can use to effectively manage water on the farm, and increase producers' resiliency against increasingly variable and extreme weather. The Farm Water Planning Toolkit was developed early in 2014, incorporating Internet research to identify resources and best practices for farm water management, and interviews of producers and other stakeholders to understand the context for farm water planning in the Cowichan region. The Toolkit complements existing resources and programs including the Environmental Farm Plan (EFP) process. The Toolkit is designed to guide producers through:

1. A careful review of current water resources, systems and practices on the farm;
2. An analysis of significant water issues and opportunities; and
3. Development of practical strategies to address issues, take advantage of opportunities, and build resilience against uncertain future conditions.

The Toolkit consists of a set of questions organized in five modules, and includes resource materials that are used in completing these modules. For pilot testing it was intended that a facilitator (consultant) familiar with the Toolkit and resource materials would assist the producer with completing the questionnaires. The structure of the Toolkit is illustrated in Figure 1.

The Toolkit modules were developed in Microsoft Excel to allow calculations to be automated, and were printed and assembled in loose-leaf binders with "Tools and Strategies" resource materials for use in the pilot interviews. Colour coding was used to clearly differentiate the modules and resource materials. A combination of qualitative and quantitative information is collected and processed in the Toolkit to identify a prioritized set of water management strategies for the farm.

Figure 1: Farm Water Planning Toolkit Structure

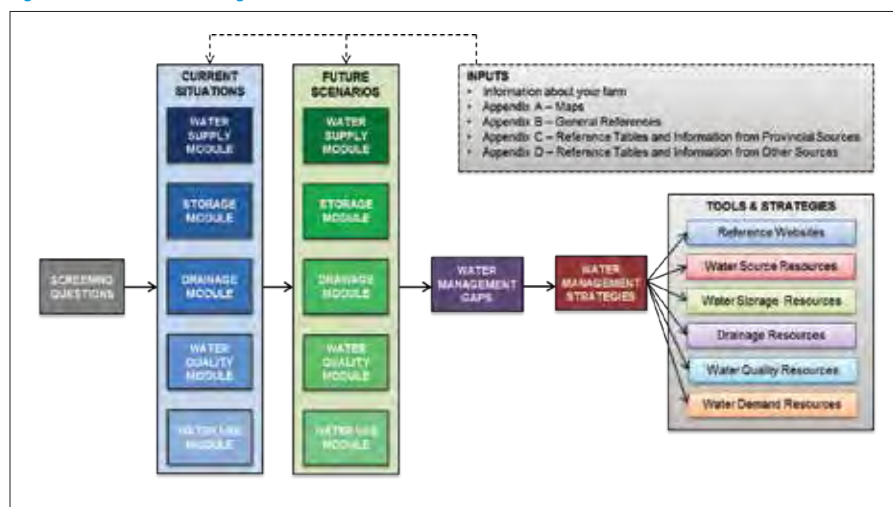
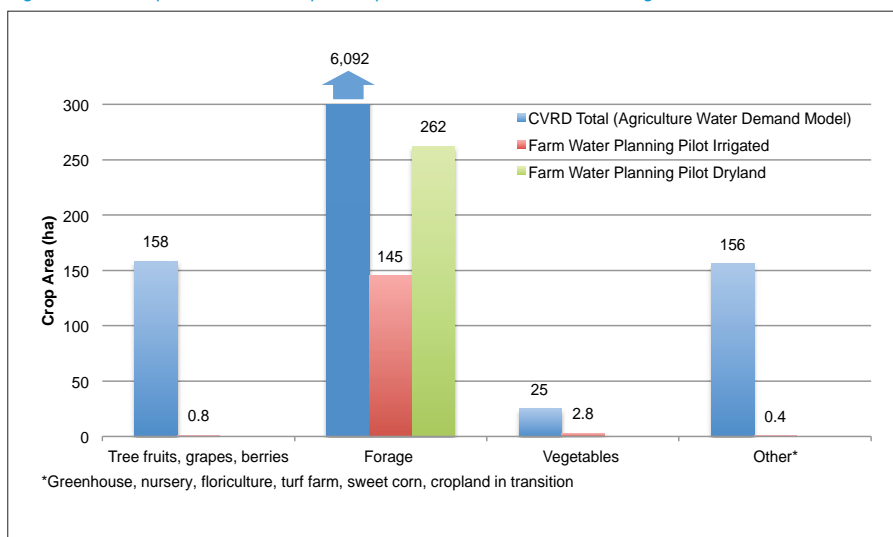


Figure 2: Pilot Sample Characteristics [please update colours to match article design]



FARM WATER PLANNING PILOTS

The Farm Water Planning Toolkit was piloted with nine producers in the Cowichan region between September 2014 and February 2015, and results were reported in July 2015. The planning process followed the same general sequence of steps with each producer:

- 1. Preparation** – The consulting team contacted the producer to schedule a farm visit, prepared a base map of the producer's home farm, and identified wells and surface water licenses for the property from provincial databases.
- 2. Interview** – 2-3 members of the consulting team visited the home farm to conduct an interview with the producer at the home farm to complete the Toolkit forms, with a focus on the most significant water management issues (typically 2-3 hours).
- 3. Field Review** – During the farm visit, the interviewers inspected wells, stream diversions, pumps, storage ponds, irrigation equipment, irrigated areas, drainage ditches, areas susceptible to flooding and other significant water management features.
- 4. Report** – A brief form report was prepared based on the information collected in the farm visit, and subsequent analysis using the Toolkit worksheets in Excel.
- 5. Follow-Up** – The report was presented and discussed with the producer in a follow-up visit by a member of the consulting team.

For piloting, no more than two farm visits were scheduled per day to ensure sufficient time to complete the process. For each producer, the complete pilot process typically required three to four hours of the producer's time and 11 to 18 hours of consultant time.

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The nine farms included in the pilot represented a combined 411 ha, 6.4% of the 6,431 ha total area in cultivation in the Cowichan Valley Regional District. The nine pilot farms included 149 ha under irrigation, which is 9.4% of the 1,593 ha total irrigated area in the region. The pilot farms also reasonably represented the diversity of agricultural land uses and geographic distribution of agriculture in the Cowichan region. A breakdown of the pilot sample by major land use is compared with regional totals from the *Agriculture Water Demand Model* report for the Cowichan Valley Regional District (Ministry of Agriculture, 2013) are shown in Figure 2.

KEY FINDINGS

The pilots provided a clear overall picture of how water is sourced, used and managed on farms in the Cowichan region. However, there is a large margin of uncertainty in the results, likely in the range of 30 to 50%, as volumes and flow rates were not directly measured by any of the pilot participants. The analysis relied on bottom-up estimates based on available pump and system data collected in the field and through interviews, producers' estimates of durations of operation of irrigation equipment, and published unit water demands for livestock watering and other uses.

The primary water source used by the nine producers who participated in the pilots is groundwater. The combined nominal capacity of the water sources used by the pilot cohort is approximately 2.5 million cubic metres (Mm³) per year, and 90 litres per second (L/s) peak flow rate. These estimates are based primarily on drillers' estimates of well yield, and are highly uncertain. The sustainable capacity of the sources is likely to be substantially lower. All water sources are subject to year-to-year risks of a shortfall due primarily to drought.

The large majority of water use is for irrigating forage grasses grown for hay that is used primarily for feeding dairy cattle (Figure 3). Nonetheless, only 36% of the forage land in the pilot cohort is irrigated. This implies that dairy forage production in the Cowichan region is highly vulnerable to drought. The major dairy producers in the pilot cohort have adapted to drought risk not by developing water supplies to bring more forage land under irrigation, but by buying or leasing available land for forage production.

Where they do irrigate, the pilot cohort apply much less water on average than would be required to maximize crop production. Irrigation is used primarily to finish a second cutting of forage grass typically in mid-July, and producers do not irrigate through the hottest part of the summer to obtain a third and possibly fourth cutting. Although it may be possible to increase hay production by 50% or more by irrigating through the remainder of the season, either



Photo credit: Colwyn Sunderland

the water sources are insufficient to supply the volume of water required or the value of hay does not justify the cost of irrigating late in the season. The irrigation requirements estimated using the *Agriculture Water Demand Model*, based on maximizing crop production, are compared with the estimated water use from the pilots in Figure 4. Precipitation was relatively high in the summer of 1997, while the summers of 2003 and 2014 were both relatively dry. This indicates that actual irrigation water demands may be in the order of 30-50% of the water needs estimated using the demand model.

All water sources are vulnerable to changes over time, although the risk levels and causes vary. Producers in the pilot cohort were generally unprepared to address the range of future challenges for their farms and operations, which included climate change, upland development, and changes in aquifer use by others.

Seven of the nine farms in the pilot cohort were found to have significant issues with drainage and/or runoff. With the exceptions of aging and uncontrolled tile drains, the drainage and runoff issues are outside producers' direct control. Four of the nine farms in the pilot cohort have tile under-drains in some fields.

The following key issues with farm water management were identified through the nine pilots:

- Information gaps and inaccuracies;
- Groundwater vulnerability;
- Risks with all types of water source: Over-allocation, cost and consecutive droughts;

- Water quality for domestic use (insufficient treatment);
- Runoff water quality risk;
- Lack of measurement;
- Uncertain irrigation efficiency; and
- Reliance on dryland forage.

At follow-up farm visits, producers were asked what was most and least valuable about the Farm Water Planning process, and what recommendations they would most likely implement in the short-term. Producers generally



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found the comprehensive and adaptable planning and prioritization process to be useful, were pleased to receive the farm water plan documents provided at the end of the process, and indicated clear intent to act on the top priority recommendations within a few years. Criticism included redundancy of some planning questions in the Toolkit. Some producers expressed a desire for funding to support further implementation of the Toolkit. The recommendations most likely to be implemented included development of water sources or storage in preparation the *Water Sustainability Act*.

WHAT NEXT?

The pilots identified several minor refinements that should be made to the Farm Water Planning Toolkit, primarily to improve the efficiency of the process. The Toolkit may be useful in helping producers understand their water needs in order to navigate through groundwater licensing requirements that will come into effect in 2016 under the *Water Sustainability Act*. There are important opportunities for the Toolkit to be used collaboratively by neighbouring producers who share a water supply or drainage problem, or with other nearby landowners, local governments

and other government agencies. There are opportunities to pilot the use of drought-resilient crops and farming practices including irrigation system assessments.

Perhaps most importantly, the pilot indicates a need for producers to begin measuring and recording water supply flows, water demands and significant runoff and drainage issues. As every water utility operator knows, recording and trending data is the key to identifying problems and correcting them before they become emergencies.

ABOUT THE AUTHOR



Colwyn Sunderland is a project manager with Kerr Wood Leidal, specializing in municipal infrastructure management, and water use and conservation planning. Before joining Kerr Wood Leidal in 2012, Colwyn served for eight years with the Capital Regional District, where he administered several water and sewer services and developed water conservation programs for the for the industrial, commercial and institutional sectors.

Colwyn is a past-President of the BCWWA, and is currently serving as BCWWA's representative on the board of the Canadian Water and Wastewater Association, where he currently serves as President.

ACKNOWLEDGEMENTS

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Figure 3: Estimated Annual Water Use of Pilot Cohort (m3)

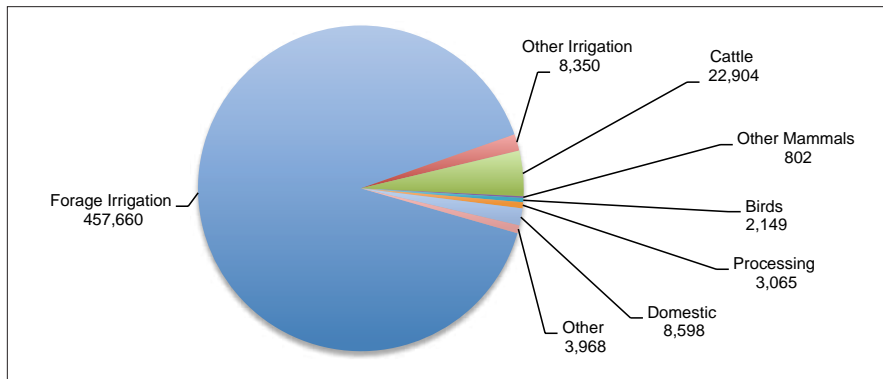
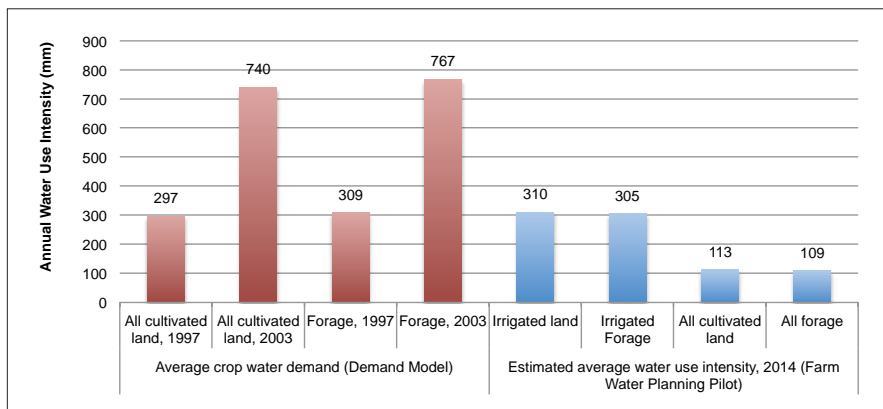



Figure 4: Comparison with Agriculture Water Demand Model








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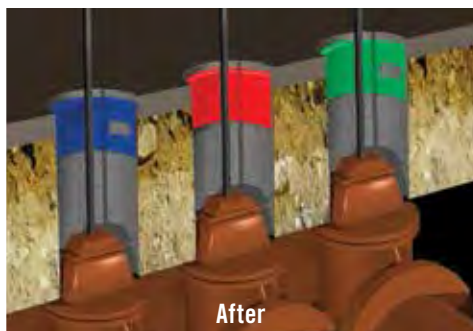
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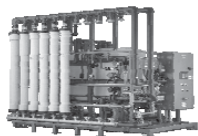
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Building a water treatment
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THE CASE OF KUGAARUK, NUNAVUT

By Cheryl Gomes, M. Eng.

Located within the Arctic Circle, Kugaaruk, Nunavut has the record for the coldest wind chill ever recorded in Canada (-92°C , 1975). Besides July and August, temperatures fall below 0°C all year in Kugaaruk. Which begs the question: How do the 800 residents of this remote community with year-round freezing conditions obtain drinking water?

The process of designing, building, operating, and maintaining a water treatment plant (WTP) for cold, remote regions has a unique set of challenges, which may not arise for large urban centers in other regions of Canada. Here is a look at the case of Kugaaruk, Nunavut.

THE FIRST WATER TREATMENT PLANT IN KUGAARUK

Kugaaruk is a predominantly Inuit community on the shore of Pelly Bay in Nunavut. The first water treatment plant (WTP) in Kugaaruk was completed in 1988, when its population was 300.

HIGHLY VARIABLE RAW WATER SOURCE

The WTP draws raw water from a small, shallow man-made reservoir along a river. The surface is frozen most of the year, which reduces the depth of raw water available and can increase turbidity. When the frozen surface thaws for a few months of the year, the reservoir is no longer protected from surface run off. This significantly alters the raw water quality and can result in high levels

of sediments. In January 2010, a saltwater surge contaminated the reservoir, which is located only 2km northeast of the Arctic Ocean. The plant was temporarily shut down; forcing the Hamlet of Kugaaruk to manually draw water from farther upstream and use sleds to transport water vessels to the residents. In other words, the raw water source is highly variable, which can make it considerably difficult to design a WTP. Furthermore, water quality data is not readily available for Arctic regions.

TRUCKS DELIVER CHLORINATED WATER TO EVERY HOME

Extensive permafrost and frost heaving make it impossible to install underground infrastructure,

which is typically used to deliver potable water from a WTP to end-users. Aboveground distribution networks are sometimes used in Arctic communities; however, all infrastructure must be insulated and water must constantly be circulated to avoid freezing. This can become costly to install and maintain. A truckfill system is an appealing alternative for a small (5km²) community like Kugaaruk. Plant operators fill trucks with potable water and deliver the water to the community, by filling hundreds of water storage tanks that are located outside every house or public building. Each storage tank is connected to the facility to transport water inside. The original WTP treated the water using chlorine only and the water was then delivered to every home using the truckfill system.

THE URGENT NEED FOR A PLANT UPGRADE

As decades passed, the WTP became inadequate for a number of reasons:

- Useful life: The WTP was designed to last 20 years. By 2014, the WTP was in operation for 26 years. Physical deterioration of the equipment was significant.
- Flow rate: The WTP was designed to serve up to 450 residents by producing water at a rate of 17L/s (260GPM). While this was meant to accommodate the future growth of the community, the population increase was significantly underestimated, with a population of nearly 800 by 2014. Furthermore the flow rate could not meet the fire demand if an emergency fire occurred.
- Treatment technology: The WTP treated the raw water using chlorine only. As Canadian standards for drinking water quality became higher, further treatment would become necessary to provide potable water.
- Public perception: Residents believed their health was at risk if they consumed the water produced from the original WTP and instead they relied on filtered or bottled water.

The WTP was in desperate need of an upgrade. In 2014, BI Pure Water and Williams Engineering teamed up to deliver a new WTP for the Government of Nunavut. Team work and constant problem solving was critical to ensure project success.

DESIGNING THE NEW WATER TREATMENT PLANT

In 2013, a new system was designed to treat the highly variable reservoir water and provide potable water to the community, using the truckfill delivery method already in place. Resilience was a key design parameter so that the plant could withstand freezing conditions throughout the year. The plant walls were insulated with (10cm) polyurethane panels, and bullet proofed with (0.3cm) steel lining to accommodate the local hunting lifestyle. Plant mobility was another key design parameter.

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The community intended on eventually building a new water reservoir farther from the Arctic Ocean, to prevent recontamination by saltwater. The plant was manufactured as a fully portable unit so it could easily be relocated to the new reservoir in the future. The treatment system included a custom filtration system, ultraviolet (UV) for primary disinfection and chlorine for secondary disinfection. This schematic was duplicated to have two independent treatment trains, providing redundancy and allowing two trucks to be filled simultaneously. Water could be produced at 40L/s (600GPM), which could meet the fire demand if needed. The plant was manufactured and tested in Surrey to minimize work required on site.

WORKING ON SITE WITH LIMITED RESOURCES

Resources for industrial activity are limited in Kugaaruk, which can make site work very costly. At the time, the only excavator in town was rented at approximately \$1000 per day. Instead an excavator was purchased in Surrey, shipped to Kugaaruk for site work, and later offered to the community at cost, for future use. Shipping supplies to Kugaaruk may be the most difficult compared to any other Canadian Arctic community. Kugaaruk is situated on a rock outcrop and its geographic location is subject to ice jams. Cargo delivery ships cannot access the community.

Airfreight can be used to deliver goods to Kugaaruk, but it is expensive and flights are often cancelled due to blizzards or high winds. Sometimes it takes months to clear the backlog of goods to be shipped by airfreight. Alternatively, the Canadian Coast Guard delivers goods to Kugaaruk using massive icebreaker vessels. Economically, this is the most attractive option. However, deliveries are only made once a year, meaning extensive planning and commitment to schedule are crucial. Any small delay could cause a one-year setback. The plant was delivered via the Canadian Coast Guard in September 2013, and commissioned by October 2014 (Figure 1). The previous WTP from the '80s was refurbished to provide chlorine storage and supplied power from a backup generator.

PROJECT OUTCOMES AND OVERCOMING ONGOING CHALLENGES

The community was pleased with the new WTP. However, when the ice melted in August 2014, spring run off affected the quality of the reservoir water. The filters needed to be replaced earlier than expected. A depleted filter supply was not ideal for Kugaaruk, since the specialty filters took months to produce and shipping items from factory to Kugaaruk is no quick task. In January 2015, BI Pure modified the plant design by changing the filter arrangement

from a series to parallel configuration, which significantly extended the useful life of the filters. A large supply of replacement filters was also kept on hand in Kugaaruk to ensure the community would not run out. Additionally, remote monitoring capabilities were installed to collect water quality data and troubleshoot any future concerns, minimizing the need for service visits to Kugaaruk.

Although there were many weather related and logistic challenges, thanks to the support from the Hamlet of Kugaaruk, local workers and the Government of Nunavut, the new WTP proved to be a successful project and the pride of the community. Locals informed us that they no longer rely on filtered or bottled water and have confidence in their new WTP.

ABOUT THE AUTHOR



Cheryl Gomes, M. Eng., completed her B. Sc. in Chemistry at McGill and M. Eng. in Chemical and Biological Engineering, with an Engineering Management sub-specialization at UBC. Both degrees focused on water chemistry, water/wastewater engineering and economics. After completing her UBC thesis, she worked as a project engineer and sales engineer in the water treatment manufacturing industry. 💧



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MOVING BEYOND THE DEBATE TO FOCUS ON RISK AND RESILIENCY

BY STEVE CONRAD, ASSOCIATE DIRECTOR OF THE PACIFIC WATER RESEARCH CENTRE,
CO-CHAIR OF THE RISK AND RESILIENCE COMMITTEE, BCWWA

MOVING BEYOND THE DEBATE

A major limitation of the past climate change debate is its framing of whether or not there is a close relationship between humans and climate change. This framing has directed attention away from examining and preparing strategies for addressing the impacts of climate change. It is unquestionable that climate change will greatly influence water systems. It is also certain that climate change will change the frequency, magnitude and characteristics of weather events. Yet it is sometimes uncertain where and how water systems will be impacted and further uncertain how institutions will change in response to climate change. Water community professionals and researchers have given considerable effort to refining this uncertainty, but in doing so have diverted needed work away from preparing for the inevitability of change.

A key flaw in how we have been addressing climate change uncertainty is in viewing risk and vulnerability as something new and only now

emerging in relationship to climate change. Yet we can see by the past events of the Alberta flooding in 2013, United Kingdom flooding in 2014, and now the New Brunswick flooding in 2015 that risk is a constant factor – disrupting events can occur anytime and anywhere. Yet because complex processes influence these events they are also forgotten over time. Climate change uncertainty should instead be viewed as an overlay to existing variability and stressors where some water systems will be more impacted than others. Going forward we need to turn our attention from questioning this impact to questioning how can we prepare water systems. It is time to move beyond the debate of cause and uncertainty to one of how we can cooperate in putting forth resources to manage risk and improve water system resilience.

RECOGNIZING RISK AND UNCERTAINTY AND PREPARING RESILIENT SYSTEMS

I would like to take a moment now to share events within the Climate Change Committee that is

positioning our committee to attend to those issues of climate change that are most important to the water community. Recently the Climate Change Committee has merged with the Emergency Management Committee to form a new committee on Risk and Resilience. This merge does not signal a lessening of attention to climate change, but instead gives direction to the importance of pushing the climate change debate beyond the question of whether water systems will be affected by climate change to one of intentional action on identifying strategies for the future.

Going forward, the Risk and Resilience Committee will look beyond approaches that emphasizes managing risk by looking to avoid service interruptions or helping water utilities simply adapt to the impacts of climate change. We will look to innovations, new approaches for water financing, federal support of infrastructure improvements, water security, research, and community collaborations to guide policy and practices to prepare water systems that are resilient to not only climate change disturbances, but also all disturbances. 💧

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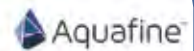
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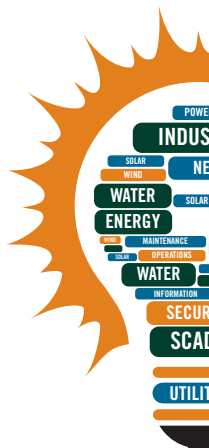
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THE EVOLUTION OF NUTRIENT RECOVERY

BY PHILLIP ABRARY, PRESIDENT, CEO AND CO-FOUNDER, OSTARA NUTRIENT RECOVERY TECHNOLOGIES

Ten years ago, the nutrient recovery industry didn't truly exist. Today, it is a full-circle sustainable solution being adopted by wastewater treatment plants (WWTPs) in cities and municipalities worldwide.

Traditionally, WWTPs removed phosphorus from wastewater streams by precipitating them with iron or aluminum salts, and then removing the precipitate in the plant biosolids. It was an intensive chemical process that not only generated excess biosolids, but also required the purchase of metals salts and the disposal of the metal phosphate sludge. Removal with chemical flocculants is both expensive and considered harmful to the environment. The produced biosolids were applied to land, and phosphates bound by iron or aluminum salts were not readily plant available.

The process of removing phosphorus biologically, known as Enhanced Biological Phosphorus Removal (EBPR), began in the 1960s, but wasn't common until the 1990s. Instead of chemicals, the process relies on phosphate-accumulating organisms to consume dissolved phosphates. While EBPR provides a low-cost, environmentally friendly solution for facilities to remove phosphorus, anaerobic digestion of wastewater sludges containing phosphate-accumulating organisms causes phosphorus to be released by the organisms. When released, the

phosphate reacts with ammonia and magnesium already present to form struvite, which can cause severe scaling of pipes, process equipment and digesters. To prevent struvite buildup, the WWTP must resort to chemical phosphorus removal using metal salts. It also prevents released phosphorus from recirculating back to the EBPR process. In recognition of the potential value of these nutrients, alternative solutions involving the precipitation and extraction of the phosphates from post-digestion sludge dewatering liquors were developed. These processes were effective at recovering phosphorus, but unable to create a valuable product that could be successfully commercialized.

In the early 2000s, a group of researchers in the Department of Civil Engineering at the University of British Columbia (UBC) invented a process to recover phosphorus in a fluidized bed reactor. The purpose was to create a high-value fertilizer. What set this process apart from others was its ability to create a pure product that would be suitable for fertilizer consumers, increasing the chances of commercial adoption. The technology provided a second outlet for the released phosphorus by turning it into a granular fertilizer and allowing phosphorus to be recovered. It also meant money no longer had to be spent on sludge-producing metal salts.

OSTARA NUTRIENT RECOVERY TECHNOLOGIES INC.

In 2005, when the UBC technology passed the pilot stage and was ready for commercialization, Ostara Nutrient Recovery Technologies Inc. was formed and licensed it. Within two years, Ostara scaled up the technology by a factor of 100 from laboratory to commercial scale with a demonstration facility at the City of Edmonton's Gold Bar WWTP. This full-scale demonstration facility, which produced marketable fertilizer, was instrumental in convincing other municipalities to invest in this process. Within a year, Ostara sold its first system to Clean Water Services in Oregon. The Edmonton facility, operated by EPCOR, has since been upgraded and by the spring of 2016 will launch Canada's largest nutrient recovery facility.

The product created from Ostara's process is a 99.6 per cent pure crystalline phosphate fertilizer, marketed as Crystal Green®. Ostara has led the research and market development of Crystal Green, which is now being sold to the agriculture and turf industries in North America and Europe. Revenues from the sale of Crystal Green are shared with municipalities, helping to offset the capital cost of installation of the nutrient recovery process.

The fertilizer is considered unique due to its water insolubility and continuous release properties, meaning it releases responsibly,





Figure 1: Photo of Ostaria nutrient recovery facility in Saskatoon

Using Ostaria's Pearl 2000 system, Saskatoon's nutrient recovery facility has an annual production capacity of 730 metric tons of Crystal Green fertilizer, and the City receives revenue from the sale of the Root-Activated™ fertilizer.



significantly reducing the risk of leaching and run-off. This helps to protect adjacent waterways from excessive nutrients, which can result in algae blooms that destroy precious ecosystems.

Environmental policy is now focussed on reducing nutrient runoff in places like Lake Winnipeg. Last summer, Ontario Premier Kathleen Wynne and the governors of both Michigan and Ohio signed an agreement to dramatically reduce the input of phosphorus into the western waters of Lake Erie by 40 per cent over the next decade. Phosphorus management is also a concern in BC's Fraser and Okanagan Valleys and other watersheds where water quality is a worry.

As a result of this growing concern and increased recognition of the issue by provincial and federal governments, municipalities across North America are actively seeking innovative technologies to respond to increasingly stringent phosphorus limits – and to do their part to help clean up the environment. Municipalities in North America and Europe now have a viable cost effective nutrient recovery system to manage these excessive nutrients. Ostaria has multiple facilities throughout North America and Europe today and is set to open the world's largest nutrient recovery facility, in partnership with the City of Chicago, later this year.

As WWTPs face increasingly stringent phosphorus limits, the evolution of nutrient recovery to a cost-effective and environmentally friendly process to manage nutrients is welcome news.

In fact, WWTPs no longer view themselves as sewage or waste treatment facilities but instead as "resource recovery centers," where water, energy and nutrients are recovered and recycled for beneficial reuse.

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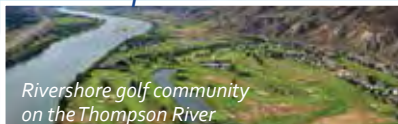
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The BC Water & Waste Association's Student Design Competition (SDC) promotes real world design experience for students interested in pursuing a career and/or education in water and wastewater engineering and sciences.

This year, student teams were asked to design a treatment process for the Resort Municipality of Whistler's (RMOW) Wastewater Treatment Plant to reduce the amount of phosphorus discharged to the Cheakamus River with the treated effluent.



Image credit: Mike Crane, Resort Municipality of Whistler

Stay tuned – the winning team will be announced in April!
Check out www.bcwwa.org/events/student-design-competition for the latest information.

Meet the 2016 teams from UBC!

Team Aquatech Solutions

Leah MacGillivray
Matthew Waldie
Kelsey Baker
Danielle Gutwillinger
Trudy Miller
Travis Reid

Team CHBE

Rupekanwal (Komi) Singh Chandi
Ajai Hundal
Peng Chang
Michael Norman Birkeland Olson
Joban Laura
Patrick Marcel Elliot Warren

Team Clarify Consulting

Sarah Bergstrom
Monrit Chatha
Andrei Radu
Cambria Banks
Achintya Verma

Team Crystal Stream

Athanasios Kritharis
Will Xi
Will Gumboc
Alvaro Valcarel Jervis
Aleksandra Rahman
Vasily Triandafilidi

Team DKDC

Andrew May
Tampriye Asawo
Lim Chong Siang
Yohan Wiputra
Joshua Redmond
Ivo Handjiyski

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In January, the teams completed a site tour of the RMOW's Wastewater Treatment Plant. Special thank you to Michael Day and the team at the RMOW.



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David Poole P.ENG., M. ENG.

(NOVEMBER 19, 1931 - DECEMBER 12, 2015)

WRITTEN BY DAVID'S SON, GREG POOLE



David died on December 12, after a brief illness. Born in Johannesburg, South Africa, David moved his family to Canada in 1960, where he established a successful career in engineering. His much sought after expertise in water treatment took him to all corners of the world, consulting on projects that gave millions of people access to clean water. While his career did not define him, the passion, integrity and generosity of spirit that he displayed with his colleagues, and those he mentored, extended well into his circle of friends and among his beloved family. With friends and family, he spent many joyful hours holding court at the dinner table or on the golf course, cracking stolen jokes and dismissing conspiracy theories.

David is lovingly remembered by his wife, Joan; his sons Mark (Valerie), and Greg (Barb); his daughter Penelope (Aaron); his eight grandchildren and many nieces and nephews. He will also be sadly missed by Hudson. David simply made all our lives better. It was an absolute honour to love this man and be loved by him. 💧

“David simply made all our lives better. It was an absolute honour to love this man and be loved by him.”

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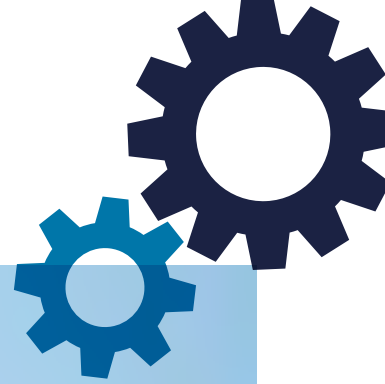
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Operator Outlook

BC Water & Waste Association is pleased to bring you stories from the field, and the latest from the world of operations. Enjoy!



IT'S ALL ABOUT PEOPLE: THE ROLE OF WATER OPERATORS IN ENSURING SAFE DRINKING WATER ACCESS IN RURAL AND REMOTE FIRST NATIONS COMMUNITIES

BY KAITLYNN LIVINGSTONE AND MADJID MOHSENI,

DEPARTMENT OF CHEMICAL AND BIOLOGICAL ENGINEERING, UNIVERSITY OF BRITISH COLUMBIA

Lack of access to safe drinking water is an issue that is disproportionately affecting First Nations communities throughout Canada. This is a complex issue to address as there are often multiple interdependent root causes and there is no “one-size-fits-all” solution for communities. The complexity of this issue is compounded in many First Nations throughout British Columbia as there are many communities with small populations located in rural and remote locations. This can add additional challenges related to the design and affordability of treatment systems as well as the recruitment, training and retention of staff to operate and maintain these systems.

This work aimed to better understand the challenges facing rural and remote First Nations communities in BC. A series of interviews were conducted with First Nations water operators from throughout the province in order to learn more about their job satisfaction, motivation, training, and support systems. In addition, some

in-depth community engagement activities were undertaken with community members in three communities in order to better understand how people viewed their water and the connections between water and health.

One of the key findings of this work is that each community is facing unique issues in relation to their water. The drinking water solutions required must be as unique and dynamic as the community they serve. Solutions must be community based and developed in partnership with community leaders, water operators, and members. Though water treatment technology and infrastructure are crucial parts of the solutions for communities, they cannot be designed without consideration of the community they are being designed for. Community engagement is essential to ensure that technology and infrastructure is appropriate for the community, and that the community has the capacity to operate and maintain their system over long-term.

CONCERNS FOR THE FUTURE

Many community members who participated in this work spoke of the importance of ensuring that there is safe drinking water for future generations. Community members described the changes that they have seen and the negative impacts that resource extraction has had on their water sources. They expressed concern for what the future will bring and a need to be able to adapt and protect their water. These concerns connect directly to the theme of this issue and lead to a very important question: What do communities need in order to ensure that their treatment system and those that operate and maintain it are resilient, resourceful and ready to provide safe drinking water for now and in the future?

Based on our work with First Nations operators and community members, we believe that the answer centers around one key component: **investing in people**. Community appropriate design requires relationship building between

those designing water treatment systems and the communities that these systems will serve. Training and supporting water operators to ensure that they have the tools they need to provide the residents with safe drinking water is crucial to ensure long-term safe drinking water access in communities.

WATER OPERATOR TRAINING

At the core of operation and maintenance of water treatment systems are the water operators who are running these systems. Water operators are on the frontline of protecting the health of their communities through the provision of safe drinking water. In order to ensure the proper operation of drinking water treatment systems, it is important that water operators have access to training courses and that these training courses are meeting the needs of operators.

Overall, water operators who participated in this work reported having positive experiences with training and found training courses to be accessible to them. Hands-on training was highly valued by operators as was having training provided by experienced operators. The circuit rider training program, in which highly trained operators provide on-site support to water operators, was positively received by many operators and they valued having training and support that is directly relevant to their system.

However, challenges for operators to attend training remain, especially for operators who are traveling from the most remote communities in the province. In addition to the geographical obstacles, a number of operators do not have a back-up operator and so are restricted in leaving their community as there is no one to take over in their absence. Operators suggested having more training offered throughout the province and suggested that training could be offered in communities to still allow for hands-on training.

WATER OPERATOR SUPPORT

The support that water operators receive varies greatly by community and was found to have a significant impact on water operator's job satisfaction. Water operators do not work in isolation as there are many people who must work together to ensure that communities have access to safe drinking water. A significant relationship to consider is the one between a community's leaders and their water operator. In order to ensure that adequate funding is allocated to water treatment systems, community leadership needs to understand the importance of investing in their water treatment system and engaging water operators in decision-making. Part of this issue could be attributed to a lack of understanding about the work that operators perform as described by one operator:

"Our Councilors all thought we were just plumbers, they didn't realize we were the ones who were making sure that they have safe drinking water."

*Water operator interview participant,
May 2014*

Community decision makers must make difficult choices to determine where their budgets are allocated and unless they understand what is required to operate and maintain their water system there is a risk there will not be enough money allocated to run the system. One way to build this understanding is through asset management workshops which bring together community leadership and operators to discuss how to maintain infrastructure and budget accordingly. As well, in the event that a new treatment system is being designed, there is an excellent opportunity to engage community leaders and water operators throughout the design process to build community ownership and ensure that there is a commitment to allocating resources to run the water treatment system. These processes help to build trust between community leadership and operators, and ultimately aid in long term planning and infrastructure management.

Finally, the support that water operators receive from their peers was found to be very important. Many operators spoke to other operators on a regular basis to address both technical issues and to talk about how to address other challenges in their work.

THREATS TO WATER OPERATOR RETENTION

One of the greatest risks to safe drinking water access for rural and remote communities is having their water operator leave the community. In order to better understand the risks for water operator retention, water operators were asked about their motivation and what they enjoyed about their work. It was found that operators had a high level of pride in their work and were motivated by serving their community. As said by one water operator:

"In the end you love the job. I like providing my community with safe drinking water"

*Water operator, interview participant,
May 2014*

However, many operators reported that they did not receive any recognition or appreciation for their work from their community. This lack of support and awareness about the importance of water operators in communities is a risk to water operator retention. It is important to build the relationship between water operators and their community in order to increase water operator's job satisfaction and to decrease the risk of water operators leaving their communities due to frustrations and feeling a lack of recognition for their work.

COMMUNITY ENGAGEMENT AND BUILDING TRUST

Water operators are well placed to work with their communities to engage with community members about their water. Some ways in which water operators reported successfully engaging with their community members include holding open houses to educate community members on the water treatment system as well as sharing information through community notice boards and newsletters. Community members reported valuing this type of information and appreciated knowing more about their water. Even casual interactions between operator and community members contributed to building a trusting relationship between operators and their community. Why is this trust so important? This not only increases community's understanding about the value of the work of operators, it is also important for health outcomes in communities. In order to ensure community health, it is crucial that not only that the tap water is safe, but also community members trust and choose to drink that water.

MOVING FORWARD

Although robust water treatment infrastructure is an important piece of providing communities with long-term safe drinking water access, what will make communities resilient, resourceful and ready for the future will be the people who are involved in operating and maintaining these systems. Well-trained water operators who are supported by community members and leaders will ensure that communities have a safe water supply both for now and for future generations.

ABOUT THE AUTHORS



Kaitlynn Livingstone

completed her undergraduate and master degrees in the department of Chemical and Biological Engineering at the University of British Columbia.

Her master's thesis focused on drinking water access in rural and remote First Nations communities in British Columbia.



Madjid Mohseni is a professor in the Department of Chemical and Biological Engineering at UBC. He is the scientific director of RES'EAU-WaterNET NSERC Strategic Network

on Small Water Systems.

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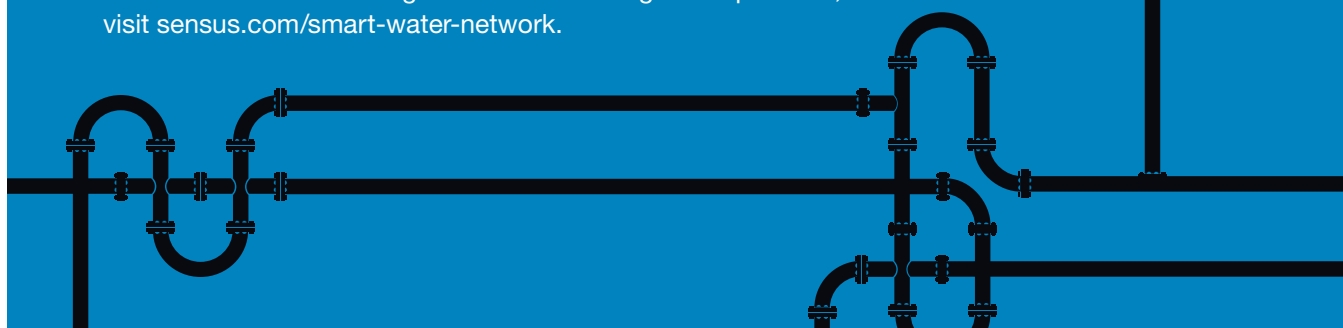
The authors would like to extend gratitude and appreciation to all of the water operators and community members who participated in this work. 💧

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Unidirectional Flushing	Course Name	CEUs	Location
April 1-June 30	Online Courses Water Treatment 1 Water Distribution 1 Wastewater Treatment 1 Wastewater Collection 1 Small Water Systems Small Wastewater Systems	2.4 CEU 2.4 CEU 2.4 CEU 2.4 CEU 1.2 CEU 1.2 CEU	Online
April 11-15	Water Boot Camp Water Treatment 1 Water Treatment 2 Water Distribution 1 Water Distribution 2	2.4 CEU 2.4 CEU 2.4 CEU 2.4 CEU	Vancouver
April 11-12	Water Quality & Sampling for Water and Wastewater	1.2 CEU	Vancouver
April 18-22	Wastewater Treatment 1 Wastewater Collection 1	2.4 CEU 2.4 CEU	Victoria
April 21-22	Small Water Systems Boot Camp Small Water Systems (T/F)	1.2 CEU	Nanaimo
May 4-5	Post BCWWA Conference Course Supervisory & Leadership Skills for Operators	1.2 CEU	Whistler
May 24-25	Small Water Systems	1.2 CEU	Kelowna
May 26-27	Small Wastewater Systems	1.2 CEU	Kelowna
May 30- June 3	Management Skills Certificate Program Module 1: Managing People	3.0 CEU	Vancouver
June 6-10	Wastewater Boot Camp Wastewater Treatment 1 Wastewater Treatment 2 Wastewater Collection 1 Wastewater Collection 2	2.4 CEU 2.4 CEU 2.4 CEU 2.4 CEU	Vancouver
June 13-17	Chlorine Handling	3.0 CEU	Vancouver
Sept. 6 - Dec. 1	Online Courses Water Treatment 1 Water Distribution 1 Water Distribution 2 Wastewater Treatment 1 Wastewater Collection 1 Small Water Systems Small Wastewater Systems	2.4 CEU 2.4 CEU 2.4 CEU 2.4 CEU 2.4 CEU 1.2 CEU 1.2 CEU	Online
Sept. 12 - 16	Water Treatment 1 Water Treatment 2 Water Distribution 1 Water Distribution 2 Chlorine Handling	2.4 CEU 2.4 CEU 2.4 CEU 2.4 CEU 2.4 CEU	Kamloops
Sept. 19 - 23	Wastewater Treatment 1 Wastewater Collection 1	2.4 CEU 2.4 CEU	Nanaimo
Sept. 26	Source Water Protection	0.6 CEU	Fraser Valley
Sept. 27	Reservoir Maintenance & Cleaning	0.6 CEU	Fraser Valley
Sept. 28	Unidirectional Flushing	0.6 CEU	Fraser Valley
Sept. 29-30	Small Water Systems	1.2 CEU	Fraser Valley

REVIEW OF HYDRANT USE POLICIES AND PROCEDURES

By Chris Twemlow, City of Vancouver



Fire hydrants are so ubiquitous that, unlike our canine friends, we probably don't notice them as we pass them by. Many would argue that a fire hydrant's sole purpose is to supply water to fight fires. In reality, most cities allow access to fire hydrants for other purposes, such as water main flushing, as fill points for flusher, water hauling, and street sweeper trucks, or as temporary water sources for construction and other applications. Hydrants even act as an inadvertent source of revenue!


The City of Vancouver allows non-fire department access to city fire hydrants in certain circumstances. Civic works crews often use

hydrants for aggregate wash-down, to provide potable water to customers whose services are temporarily shut off during construction of sewer and water mains, or for main flushing and pressure testing. Some city trucks fill water tanks used to irrigate newly planted trees. Others who require access to our hydrants are required to obtain a fee-based permit to do so. The largest number of hydrant use permits issued are to filming companies, with the remainder mostly to construction contractors for a variety of purposes.

The City has recently embarked on a review of hydrant use policies and procedures; the main components of this project are:

- **Review and revise bylaw:** This is an opportunity to modernize the bylaw language and introduce additional language to reflect changing trends in water conservation, particularly during drought events, and water security issues. The City will also look at enforcement measures to assist with compliance of the Bylaw.
- **Permit fees review:** There are a number of costs associated with issuing a hydrant use permit. These include frontline staff costs to review the application and approve the requested hydrants for use, operations staff who inspect the hydrant before and after use, water consumption charges, and if applicable, backflow and meter rental charges.
- **Water quality:** Using a hydrant without a backflow preventer can have unintended consequences in the event of backsiphonage, and that's an easily managed risk. The question is: What kind of backflow preventer? Generally, sweeper, flusher and tanker-truck fill

"Using a hydrant without a backflow preventer can have unintended consequences in the event of backsiphonage, and that's an easily managed risk."





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


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mechanisms are equipped with air gaps, so there is no concern of backflow. However, for fixed applications a backflow preventer must be used. Some cities require a double check valve assembly (DCVA), which is suitable for low or moderate health hazard applications. Others require a reduced pressure backflow assembly (RPBA), which is used for high health hazard applications. Currently, the City requires a DCVA; however, this is being reviewed. A risk analysis needs to be completed to determine what the actual or perceived risks to the water supply is. Water quality risks can also occur if the hydrant is used improperly, causing turbidity or the dislodging of tubercles, which can potentially foul downstream fixtures. These types of risks underscore the necessity that only authorized and experienced persons may access water from hydrants.

- **Water conservation:** Currently, the City does not meter the water consumed by external or internal fire hydrant users. By metering all hydrant users, we will be able to evaluate consumption data, develop benchmarks and influence conservation programs designed to encourage the reduction of potable water use. Although not likely an early deliverable of this project, we will review the potential to harness alternative water sources that can be utilized for applications such as road flushing or sweeping, certain construction processes, or possibly for irrigation. Developing an alternative water source will greatly reduce the potable water demand for these activities.

Stay tuned for updates on this project from Chris in the *Watermark* cross connection control section!

ABOUT THE AUTHOR



Chris Twemlow is the Cross Connection Program Manager with the City of Vancouver and has been with the City's Engineering Department for over 25 years. Chris sits as Chair of the BCWWA

Cross Connection Control Committee. 💧



FIRE HYDRANT FACTS FROM CHRIS!

- The term "fire plug" (a common alternate name for fire hydrant in many jurisdictions) derived from the days when water mains were made from hollowed out logs. Wherever there was a fire, the road was dug up, a hole was drilled in the main to gather water, and once the fire was out, the hole was "plugged" with a wooden stake. In later years, something similar to a standpipe was fitted to eliminate the need to dig up the road again.
- The first post or pillar type hydrant is generally credited to Frederick Graff around 1801. It was a wet barrel type with a combination hose/faucet outlet and a valve in the top. Legend has it that Graff held the first US patent for a fire hydrant, but this can't be verified because the patent office burned to the ground in 1836, destroying all the US patent records! Cast iron hydrants (similar to those in use today) became common during the mid-1800s.
- The two smaller ports (usually 2 1/2") on a standard fire hydrant are often called "ears," and the larger outlet (4" to 6") is known as a "steamer" connection because they were originally used to supply steam powered water pumps. Today it's known as a pumper connection.
- The City of Vancouver has 6,200 fire hydrants. New York City (NYC) has almost 110,000!
- As everyone knows, parking in front of a fire hydrant is a violation, sure to result in a ticket (and probably a tow). There is a fire hydrant in New York City that has generated violation tickets to the tune of \$33,000! A second fire hydrant on the same block generates almost \$25,000 in violation tickets! In all, over 315,000 tickets are issued for parking in front of hydrants in NYC, worth about \$55 million annually.
- The world's largest steel fire hydrant stands at 39 feet and can be found in Columbia, South Carolina. The world's largest working fire hydrant is in Beaumont, Texas. It stands at 24 feet and weighs about 4,500 pounds. It can blast out 1,500 gpm. The largest hydrant in Canada is a 29.5 footer located in Elm Creek, Manitoba (finally, a reason to visit Manitoba!).

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Speakers will include:

- **Chris Twemlow** – *Cross Connection Program Manager and Chair of the BCWWA's*

Cross Connection Control Seminar

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CCC Committee. Chris will present on the new City of Vancouver CCC Bylaw, recent backflow incidents in the City of Vancouver and other topics related to running a CCC program for BC's largest municipality.

- **Gavin Murgatroyd and Scott Benson** – *CCC Program Official and CCC Inspector with District of Squamish.* Gavin will tell the story of the development of the District's CCC program and Scott will speak to his role conducting CCC inspections for the District.

- **Stephen Little** – *Vancouver Airport Authority.* Stephen will present on some of the unique situations and challenges related to the application of backflow protection that have come up for the airport authority.
- **Paul Allen** – *BC Backflow Testing and Service.* Paul will be sharing stories and advice on testing in the Lower Mainland and the role of the tester.

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Cross Connection Control Exam Schedule

Please visit the BCWWA CCC exam calendar at www.bcwwa.org/ccc/upcoming-exams for more information and updates



Date	Examination Type	Training Institute	Location
April 1, 2016	Tester Recertification Exam	MTS Inc.	Vernon
April 1, 2016	Tester Certification & Recertification Exam	Pacific Vocational College	Burnaby
April 9, 2016	Tester Certification & Recertification Exam	Camosun College	Victoria
April 13, 2016	Tester Recertification Exam	UAPICBC for City of Castlegar	Castlegar
April 18, 2016	Tester Certification & Recertification Exam	Okanagan College	Kelowna
April 22, 2016	Tester Certification Exam	BCIT	Burnaby
May 5, 2016	Tester Recertification Exam	BCIT	Burnaby
May 6, 2016	Tester Certification & Recertification Exam	Pacific Vocational College	Burnaby
May 14, 2016	Tester Certification & Recertification Exam	Camosun College	Victoria
May 28, 2016	Tester Recertification Exam	Camosun College	Victoria
June 3, 2016	Tester Certification Exam	BCIT	Burnaby
June 10, 2016	Tester Certification & Recertification Exam	Pacific Vocational College	Burnaby
June 17, 2016	Tester Certification & Recertification Exam	Pacific Vocational College	Burnaby
June 24, 2016	Tester Certification & Recertification Exam	BCIT	Burnaby
June 28, 2016	Tester Certification & Recertification Exam	BCIT	Burnaby
July 15, 2016	Tester Certification & Recertification Exam	Pacific Vocational College	Burnaby

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www.bcwwa.org/conference-registration



REGISTRATION

Register now for the 44th BCWWA Annual Conference & Trade Show – British Columbia's premier water and wastewater industry event, featuring one of the largest trade shows of its kind in Western Canada! This event is intended to facilitate professional development and networking for over 1,250 professionals working in the water industry in BC and the Yukon. See www.bcwwa.org/conference-registration for registration details.

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TYPE OF REGISTRATION	REGULAR (Feb 25 - April 25, 2016)	ONSITE (May 1 - 3, 2016)
Full Conference Delegate (member)	\$689.00	\$789.00
Full Conference Delegate (non-member)	\$799.00	\$899.00
Full Conference Operator (member)	\$689.00	\$789.00
Full Conference Operator (non-member)	\$799.00	\$899.00
Full Conference Small Water System	\$399.00	\$399.00
Full Conference Student	\$249.00	\$249.00
Small Water System - Sunday & Monday	\$159.00	\$159.00
Cross Connection Control - Sunday & Monday	\$159.00	\$159.00
One-Day Conference Pass - Monday (includes Sunday trade show)	\$449.00	\$549.00
One-Day Conference Pass - Tuesday	\$449.00	\$549.00
Trade Show Walk-Through	Free	Free
Exhibitor Upgrade to Full Conference	\$420.00	\$420.00
Additional Exhibitor	\$169.00	\$199.00
Wrap-up Event (Limited quantity)	\$40.00	—

What's included in my registration?

TYPE OF REGISTRATION

	SUNDAY		MONDAY			TUESDAY	
	Receptions	Trade Show Appy Hour	Opening Session & Breakfast	Trade Show Lunch	AGM & Reception	Lunch	Wrap-up
	Appetizers 	Appetizers & Drink 	Breakfast 	Lunch 	Drinks 	Lunch 	Food & Drink
Full Conference Delegate, Operator, Small Water Systems, Exhibitor Upgrade, or Student	✓	✓	✓	✓	✓	✓	✓
One-Day Conference Pass – Monday	✓	✓	✓	✓	✓	—	—
One-Day Conference Pass – Tuesday	—	—	—	—	✓	✓	✓
Small Water Systems – Sunday & Monday	✓	✓	✓	✓	✓	—	—
Cross Connection Control	✓	✓	✓	✓	✓	—	—
Additional Exhibitor <i>*Includes exhibitor meal</i>	✓	✓	—	✓	✓	—	—

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NOTE: Tour, seminar and additional activities require separate registration.

Trade Show Walk-Through passes provide access to exhibits, but do not include food or drink.

[Click here to return to Table of Contents](#)



SCHEDULE OF EVENTS

Check out www.bcwwa.org/conference-schedule for the latest information.

Subject to change | Updated April 1, 2016

SUNDAY, MAY 1			
TIME	ACTIVITY/EVENT	LOCATION	PAGE
12:00 - 3:00 pm	Technical Tour: Extending Glacier Life on Blackcomb Mountain Pre-registration is required. Limited capacity register early!		86
3:00 pm - 8:00 pm	Registration open	Whistler Conference Centre – Interior Foyer	77
3:00 pm - 8:00 pm	Trade Show	Whistler Conference Centre	91
	• Exhibits open (3:00pm onwards)		
	• Metro Vancouver documentary screening (3:30pm-4:00pm and 7:00 pm - 7:30 pm)	Rainbow Theatre, lower level	88
	• Operator Challenge: Water Wars (4:00 pm - 7:00 pm)	Outdoor stage at main entrance	87
	• Technology Showcase (4:15 pm onwards)	Main stage	88
	• Trade Show "Appy Hour" (6:00 pm - 7:00 pm)	Trade show floor	88
	• Young Professionals (YP) Reception (6:00 pm - 7:30 pm)	Fitzsimmons Room, lower level	88
MONDAY, MAY 2			
TIME	ACTIVITY/EVENT	LOCATION	PAGE
7:15 am	Registration open	Fairmont Chateau Whistler	
7:30 am - 8:00 am	Plated Breakfast <i>Included in full conference, exhibitor upgrade, student, one-day Monday and Cross Connection Control pass types only</i>	Fairmont Chateau Whistler – Macdonald Room	
8:00 am - 9:30 am	Opening Session - Keynote speaker, Bob MacDonald	Fairmont Chateau Whistler – Macdonald Room	79
9:30 am - 9:45 am	Coffee Break & Tabletop Exhibits	Fairmont Chateau Whistler – Frontenac and Macdonald Foyers	88
9:45 am - 11:15 am	Education Program	Fairmont Chateau Whistler Frontenac and Empress Rooms	80
	• Education presentations		85
	• Panel Session: Technology & Innovation		88
	• Cross Connection Control presentations		86
	• Small Water Systems presentations		86
10:30 am - 2:30 pm	Shuttle service to Whistler Conference Centre and back Continuous loop shuttle service	Pickup and drop off at: • Fairmont Chateau Whistler front entrance bus zone • Whistler Conference Centre Whistler Way bus zone	88
10:30 am - 2:30 pm	Trade Show		91
	• Trade Show Lunch (11:30 am - 1:30 pm)	Whistler Conference Centre – Trade show floor	88
	• Operator Challenge: Water Wars Jeopardy Challenge (11:30 am - 1:00 pm)	Whistler Conference Centre – Main Stage	87
1:45 pm - 3:15 pm	Education Program	Fairmont Chateau Whistler Frontenac and Empress Rooms	81
	• Education presentations		85
	• Panel Session: Professional Engineer and System Risk Management Plans		86
	• Cross Connection Control presentations		86
	• Small Water Systems presentations		86
2:00 pm - 4:00 pm	Operator Circuit Program <i>Open to all delegates</i>	Fairmont Chateau Whistler – MacDonald Room	87
3:15 pm - 3:30 pm	Coffee Break & Tabletop Exhibits	Fairmont Chateau Whistler – Frontenac Foyer	88
3:30 pm - 5:00 pm	Education Program	Fairmont Chateau Whistler – Frontenac and Empress Rooms	81
	• Education presentations		86
	• Cross Connection Control presentations		86
	• Small Water Systems presentations		86
4:00 pm - 5:00 pm	Operator Reception and Circuit Session Tabletop Exhibits <i>Included in operator pass types only</i>	Fairmont Chateau Whistler – MacDonald Room	87
5:00 pm - 6:00 pm	BCWWA Annual General Meeting and Reception BC Section Annual General Meeting <i>Included in all pass types</i>	Fairmont Chateau Whistler – Frontenac C Room	88



TUESDAY, MAY 3			
TIME	ACTIVITY/EVENT	LOCATION	PAGE
7:30 am - 8:30 am	Registration open, coffee, tabletop exhibits	Fairmont Chateau Whistler – Frontenac Foyer	77
8:30 am - 10:00 am	Education presentations	Fairmont Chateau Whistler – Frontenac and Empress Rooms	82
10:00 am - 10:15 am	Coffee Break & Tabletop Exhibits	Fairmont Chateau Whistler – Frontenac Foyer	77
10:15 am - 11:45 am	Education Program - Education presentations - Panel Session: Implementing Sustainable Service Delivery	Fairmont Chateau Whistler – Frontenac and Empress Rooms	83 85
10:30 am - 12:00 pm	'Best of the Best' Tap Water Taste Test	Fairmont Chateau Whistler	89
11:45 am - 1:45 pm	Luncheon and Awards <i>Included in full conference, exhibitor upgrade, student and one-day Tuesday pass types</i>	Fairmont Chateau Whistler – MacDonald Room	89
1:45 pm - 2:45 pm	Education presentations	Fairmont Chateau Whistler – Frontenac and Empress Rooms	84
2:45 pm - 3:00 pm	Coffee Break & Tabletop Exhibits	Fairmont Chateau Whistler – Frontenac and Empress Rooms	86
3:00 pm - 4:00 pm	Education Program - Education presentations - Panel Session: How to Build a Competent, Sustainable Workforce	Fairmont Chateau Whistler – Frontenac and Empress Rooms	84 85
4:15 pm - 6:30 pm	Wrap-up Event <i>Included in full conference,, exhibitor upgrade, student, and one-day Tuesday pass types</i> Additional tickets available for purchase	Fairmont Chateau Whistler – MacDonald Room	89

WEDNESDAY, MAY 4			
TIME	ACTIVITY/EVENT	LOCATION	PAGE
8:30 am - 11:30 am	Workshop: Groundwater Licensing Requirements Complimentary to attend; However, pre-registration is required by April 22, 2016 <i>Special thanks to the BC Ground Water Association for hosting this session.</i>	Fairmont Chateau Whistler – Frontenac A	87
10:00 am - 12:30 pm	Technical Tour: EPCOR Britannia Mine Water Treatment Plant and the National Historic Site Britannia Mine Museum Pre-registration is required. Limited capacity, register early!		86
1:00 pm - 3:00 pm	Workshop: The new Ground Water Protection Regulation Complimentary to attend; However, pre-registration is required by April 22, 2016 <i>Special thanks to the BC Ground Water Association for hosting this session.</i>	Fairmont Chateau Whistler – Frontenac A	87

KEYNOTE SPEAKER

Don't miss the opening session breakfast, featuring the host of CBC's Radio's 'Quirks & Quarks' show!

BOB McDONALD

DATE: Monday May 2, 2016

TIME: 8:00 - 9:30 am

LOCATION: Fairmont Chateau Whistler



SURVIVING THE THIRD MILLENIUM IN THE FACE OF CLIMATE CHANGE

Loved by audiences across Canada for making complex scientific issues understandable, meaningful, and fun, Bob McDonald is in high demand. A fixture in broadcasting for more than 30 years, he is currently the host of CBC Radio's *Quirks & Quarks* - the award-winning science program that is heard by 500,000 people each week - and is the author of numerous bestselling books.

In addition to hosting *Quirks & Quarks*, McDonald is a regular reporter for CBC TV's *The National* and host of the children's series *Head's Up*. As a writer, he has authored four bestselling science books, and contributed to numerous textbooks, magazines, and newspapers (including *The Globe and Mail*). His latest book is *Canadian Space Walkers: Hadfield, MacLean and Williams Remember the Ultimate High Adventure*.

McDonald has been honoured for his outstanding contribution to the promotion of science within Canada. He is an Officer of the Order of Canada and a recipient of the Queens Jubilee Medal. He has been awarded the "Michael Smith Award" from the Natural Sciences and Engineering Research Council, the "Sir Sanford Fleming Medal" from the Royal Canadian Institute, and the "McNeil Medal" from The Royal Society of Canada. He also won a 2008 Gemini Award for "Best Host in a Pre-School, Children's or Youth Program or Series." He holds eight honorary doctorates from Canadian universities.



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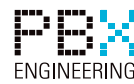
EDUCATION PROGRAM

DATES & TIMES:

Monday, May 2 from 8:00 am - 5:00 pm

Tuesday, May 3 from 8:30 am - 5:00 pm

LOCATION: Fairmont Chateau Whistler



The theme of this year's conference is Resilient, Resourceful & Ready.

The topics covered in our education program are intended to encourage discussion and knowledge sharing on current issues faced by BCWWA members and the water industry. With a keynote speaker, 80 presentations and five panels over two days, there will be sessions of interest and relevance no matter what you do in the industry!

MONDAY, MAY 2

Room	Empress A	Empress C	Frontenac B	Frontenac C	Frontenac A
TOPIC	Stream 1: Drinking Water Quality & Source Protection	Stream 2: Climate Change Preparedness & Resiliency	Stream 3: Effective Utility Management	Panel Session Technology & Innovation	Stream 4: Small Water Systems
9:45 - 10:15 am	Towards effective First Nations' source water protection: A groundwater-focused study for decision- making and long-term planning <i>Rachael Marshall, M.A.Sc. University of Guelph</i>	Integrated approach to flood hazard management <i>Lawrence Francois, P.Eng. Kerr Wood Leidal Associates Ltd.</i> Co-presenter: James Hallisey <i>Resort Municipality of Whistler</i>	The rate setting process: What level of complexity is right for your utility? <i>Karyn Johnson, MBA FCS GROUP, Inc.</i>	Technology & Innovation: How to manage risk and maximize value. See full panel description on page 85. Moderator: Jennifer Crosby, <i>Metro Vancouver</i> Panelists: Ed McCormick, Past President, <i>WEF</i> ; Brian Steglitz, VP, AWWA, Manager of Water Treatment, <i>City of Ann Arbor</i> ; Phillip Abrary, CEO, <i>Ostara Nutrient Recovery, Veolia</i>	BCWWA's capacity building program for small water systems – What it is and how to get involved <i>Keith Kohut, M.A.Sc., P.Eng. Associated Engineering</i>
10:15 - 10:45 am	Correlation of miex resin laboratory jar test to pilot and full-scale plant performance <i>Tony Galvan, MBA Ixon Watercare</i>	The problem with red dots... <i>Andrew Wiens, P.Eng. Associated Engineering</i> Co-presenter: Eric Afghan, <i>Associated Engineering</i>	How to implement asset management in a small community without breaking the bank <i>Pat Miller, Certified Operator Sun Peaks Utilities Co. Ltd.</i>		Small communities – Big opportunities: A strategic new approach to implementing drinking water disinfection for First Nations <i>Brett Marchant, MSc. RES'EAU WaterNET</i>
10:45 - 11:15 am	Fire & ice <i>Holda Crocker PAX Water Technologies</i>	How will the new federal flood fund be rolled out?: National floodplain mapping technical working group - a CWRA update <i>Dave Murray, P.Eng., ASCT, CPESC Canadian Water Resources Association</i>	Improving financial resiliency of regulated water utilities - updates to CPCN guidelines <i>Mitchell Hahn, P.Eng. Ministry of Forests, Lands and Natural Resource Operations</i>		Community circle: A collaborative approach to ensure clean drinking water in small and rural communities <i>Megan Wood, M.A.Sc., E.I.T. RES'EAU-WaterNET</i>



Room	Empress A	Empress C	Frontenac B	Frontenac C	Frontenac A
TOPIC	Stream 6: Water Governance, Regulations & Policies	Stream 7: Emergency Preparedness & Disaster Response	Stream 8: Infrastructure Renewal, Replacement & Upgrades	Panel Session Professional Engineer and System Risk Management Plans	Stream 4: Small Water Systems
1:45 - 2:15 pm	Ready, set, law! <i>Rina Thakar, LL.B, LL.M. Civic Legal LLP</i> Copresenter: <i>Sonia Sahota, Civic Legal LLP</i>	Leaks, breaks, disasters and near misses: Stress assessment for pipes and engineers <i>Colin Kristiansen, P.Eng., MBA Kerr Wood Leidal Associates Ltd.</i>	Tenders and requests for proposals: Use of both tools in municipal wastewater engineering projects <i>Raymond Chin, P.Eng. Opus DaytonKnight</i>	Professional Engineer and System Risk Management Plans: Conceptual Approach For Improving the BC Drinking Water and Waste Water System. See full panel description on page 85.	Assessment of vulnerability of a small water treatment supply system utilizing water safety plans <i>Yvonne Post University of Guelph</i>
2:15 - 2:45 pm	The BC municipal water survey 2016 <i>Jordi Honey-Rosés, PhD Water Planning Lab, School of Community and Regional Planning UBC</i>	Best practices - Are they "good enough"? <i>Walter Bucher Raven Rescue</i>	Design build – The view from both sides. Chilliwack and Tsawwassen First Nation wastewater treatment plants <i>Tom Robinson, M.A.Sc., P.Eng. Associated Engineering</i>	Moderator: <i>Tanja McQueen, CEO, BCWWA</i> Panelists: <i>Tim Lambert, Executive Director, BC Ministry of Health; Gilbert Laroque, Associate Director, Professional Practice, APEGBC; Donny Wong, City of Vancouver</i>	Quaaout - Overcoming vulnerabilities and building strength by combining two water systems <i>Keith Kohut, M.A.Sc., P.Eng. Associated Engineering</i>
2:45 - 3:15 pm	Hitting the refresh button 20 years into Kelowna's wastewater master plan <i>Jeremy Clowes, P.Eng. Urban Systems Ltd.</i>	Permanent canal closure and pump stations (PCCP) project – design- build of one of the largest drainage pumping systems in the world <i>Reno Fiorante, P.Eng., P.E. Stantec Consulting Ltd.</i>	Pilot Scale Implementation of Water Treatment Optimization using a Hydrogen Peroxide Secondary Disinfectant in a Small Community in Newfoundland and Labrador <i>Colin Guthrie, PhD SanEcoTec Ltd.</i>		Water Sustainability Act: Implications for groundwater users <i>Marta Green Associated Environmental Consultants Inc.</i>
TOPIC	Stream 9: Stormwater Management	Stream 10: Technology & Innovation	Stream 11: Resource Recovery & Reuse	Stream 3: Effective Utility Management	Stream 4: Small Water Systems
3:30 - 4:00 pm	Introducing Richmond's daylighting strategy <i>Sara Pour, P.Eng., M.A.Sc. Kerr Wood Leidal Associates Ltd.</i> Co-presenter <i>Lloyd Bie, P.Eng. City of Richmond</i>	Peracetic acid for disinfection - Site specific testing programs <i>Michael Whalley, M.Eng., P.Eng. Associated Engineering</i>	Developing energy neutral wastewater treatment plants & the use of biological hydrolysis in anaerobic digestion <i>Robert Hacking GE Water and Process Technologies</i>	Using criticality and risk assessment to drive cost-efficient network management - The township of Langley water and sewer forcemain inspection program <i>Chris Lombard, P.Eng. MBA, AECOM</i>	Groundwater and surface water monitoring in support of municipal and commercial groundwater extraction with case studies <i>David Tiplady, P.Eng. Piteau Associates Engineering Ltd.</i>
4:00 - 4:30 pm	Comparative performance of oil-grit separators and stormwater filtration technologies for meeting enhanced water quality objectives <i>Joel Garbon Imbrium Systems</i>	Development of an accessible inclined orientation UV disinfection system <i>Brian Topp, P.Eng. Xylem</i>	Ostara's pearl® nutrient recovery solves nutrient challenges <i>Derek Lycke, P.Eng. Ostara Nutrient Recovery Technologies Inc.</i>	How the pride of independence led to playing catch up for essential services <i>Gillian Woodward, P.E. (WA) Kerr Wood Leidal Associates Ltd.</i>	Drinking water, turbidity and boil water notices <i>Olga Rivkin, LLB Bull, Housser & Tupper LLP</i>
4:30 - 5:00 pm	Can the engineers and beancounters agree on how to sustainably fund stormwater management? <i>Jason Foster, E.I.T., AECOM</i>	Process reliability and efficient operations depend on effective polymer management <i>Chris Howorth, P.Eng Veolia</i>	A compact, efficient and expandable title 22 treatment system for small water systems <i>Eric Peterson Amiad Water Systems</i>		Understanding occurrence of drinking water advisories in First Nations systems: A data mining approach <i>Emma Thompson University of Guelph</i>



TUESDAY, MAY 3

Room	Empress A	Empress C	Frontenac B	Frontenac C	Frontenac A	Empress B
TOPIC	Stream 11: Resource Recovery & Reuse	Stream 10: Technology & Innovation	Stream 2: Climate Change Preparedness & Resiliency	Stream 8: Infrastructure Renewal, Replacement & Upgrades	Stream 15: Building Public Support for Water	Stream 1: Drinking Water Quality & Source Protection
8:30 - 9:00 am	BCWWA's role in the midst of biosolids evolution / revolution: regulation, social license, science, social media changing biosolids management in British Columbia John Lavery, M.Sc.; RPBio. PAg <i>SYLVIS Environmental</i>	City of Richmond: Progression towards a universally deployed ami solution Corrine Haer, EIT <i>City of Richmond</i> Co-presenter Angela Zapp, P.Eng., MBA <i>Neptune Technology Group (Canada) Ltd.</i>	Preparing for drought – A tool to enhance climate change adaptation strategies for managing water supplies Monte Staats, MLWS	Building robust master plans: An innovative approach to create value Chris O'Donnell, P.Eng. Co-presenter: Paramjeet Mankoo, <i>Opus DaytonKnight Ltd.</i>		Latest developments in hollow fibre membrane technology globally for drinking water treatment Frans Knops <i>X-Flow</i>
9:00 - 9:30 am	Alternative biosolids management options for Metro Vancouver Laurie Ford <i>Metro Vancouver</i>	Start-up and commissioning of south fork water treatment plant Sabrina Diemert, M.A.Sc., E.I.T. <i>Associated Engineering</i>	Adapting infrastructure to improve its climate resilience Virginia Sarrazin, P.Eng., M.A.Sc. <i>Associated Engineering</i>		Community support for water and sewer systems - A city manager's perspective Kevin Ramsay, ASCT, RTMgr <i>City of Port Moody</i>	When puzzle pieces come together: An integrated approach to water quality system modeling and optimization Werner de Schaetzen, Ph.D., P.Eng. <i>GeoAdvice Engineering Inc.</i> Co-presenter Jeff Cowburn <i>City of Abbotsford</i>
9:30 - 10:00 am	Biosolids resource recovery and reuse Graeme Bethell, M.Sc. <i>QEP Pivotal IRM Inc.</i> Co-presenter Chris Corps, Pivotal IRM INC.	Case study: Whistler water distribution system corrosion study Siobhan Robinson, M.A.Sc., P.Eng. <i>Kerr Wood Leidal Associates Ltd.</i>		Pumping drinking water to communities and taking their wastewater away: two unique and state-of-the art facilities in British Columbia Arash Masbough, M.A.Sc., PMP, P.Eng. <i>Associated Engineering</i>	Nature, recreation, jurisdiction: how we squared the circle to protect whistler's water supply Gillian Woodward, P.E. (WA) <i>Kerr Wood Leidal Associates Ltd.</i>	Improved jar testing optimization with organics monitoring Sydney Sytsma <i>GE Analytical Instruments</i>



Room	Empress A	Empress C	Frontenac B	Frontenac C	Frontenac A	Empress B
TOPIC	Stream 12: Water Scarcity & Conservation	Stream 10: Technology & Innovation	Stream 8: Infrastructure Renewal, Replacement & Upgrades		Panel Session : Implementing Sustainable Service Delivery	Stream 1: Drinking Water Quality & Source Protection
10:15 - 10:45 am	Building the evidence-base for water conservation policies <i>Jordi Honey-Rosés, PhD Water Planning Lab, School of Community and Regional Planning, UBC</i>	Algal toxins removal: What are the viable treatment options for small systems? <i>Pranav Chintalapati, UBC Co-presenter Fuhar Dixit</i>	Design-build for the City of Chilliwack's biological wastewater treatment expansion <i>Tyler Barber, E.I.T., M.A.Sc. Opus DaytonKnight Consultants Co-presenter Chandra Naiduwa City of Chilliwack</i>		Implementing Sustainable Service Delivery: Asset Management from Policy, Programs to Politicians. See full panel description on page 85. Moderator: Glen Brown, General Manager, Union of BC Municipalities (UBCM)	Commissioning of the Seymour Capilano filtration project <i>Adeline Chin, P.Eng. Metro Vancouver</i>
10:45 - 11:15 am	Practical benchmarking of water loss for utilities <i>Elise Pare, P.Eng. WSP Canada Inc. Co-presenter Mike Ippen City of Victoria</i>	Cold climate nitrification and WSER: Removing ammonia from frigid lagoons <i>Merle Kroeker, BSE, P.Eng. Nelson Environmental Inc.</i>	Performance of screen technologies in wastewater <i>Siham El Murr, P.Eng. Veolia Water Technologies Canada Inc.</i>		Panelists: Brian Bedford, Ministry of Community, Sport & Cultural Development; Mike Donnelly, Manager of Water & Utility Services, Regional District of Nanaimo	The Water Sustainability Regulation and Groundwater Protection Regulation: What groundwater purveyors need to know <i>Ryan Rhodes, P.Geo., P.Geol. Western Water Associates Ltd.</i>
TOPIC	Stream 13: Other	Stream 10: Technology & Innovation	Stream 8: Infrastructure Renewal, Replacement & Upgrades	Stream 11: Resource Recovery & Reuse		Stream 1: Drinking Water Quality & Source Protection
11:15 - 11:45 am		Realizing the energy savings - High speed turbo blower installation at the Pentiction advanced wastewater treatment plant <i>Venkatesh Narayan, P.Eng. Archer Separation Process Inc. Co-presenter Randy Craig City of Pentiction</i>	Phosphorus removal using tertiary UF - How low can you go, items of importance and options for being cost effective <i>Samantha Kendrick GE Water and Process Technologies</i>	So, you say you have a fermenter ... <i>Dean Shiskowski, Ph.D., P.Eng. Associated Engineering</i>		City of Port Alberni - Bainbridge water treatment plant <i>Chris Downey, P.Eng. Koers & Associates Engineering Ltd. Co-presenter Guy Cicon City of Port Alberni</i>



Room	Empress A	Empress C	Frontenac B	Frontenac C	Frontenac A	Empress B
TOPIC	Stream 13: Other	Stream 10: Technology & Innovation	Stream 8: Infrastructure Renewal, Replacement & Upgrades	Stream 3: Effective Utility Management	Stream 11: Resource Recovery & Reuse	Stream 14: SCADA & Control Systems
1:45 - 2:15 pm	Project plans - Your path to success <i>Michael Nordquist, M.Eng., P.Eng., PMP, LEED AP BD+C MHPM Project Managers Inc.</i>	Filtration & separation using self-cleaning filtration <i>Anita Gupta, M.Sc., B.Ed. John Brooks Company Ltd.</i> Co-presenter <i>Jason Blank John Brooks Company Ltd.</i>	Pump station upgrades: when, what and how <i>Patrick Neill, P.Eng. Trittech Group Ltd.</i>	Using hydraulic modeling to develop unidirectional flushing programs – A case study with the City of Powell River, BC <i>Werner de Schaetzen, Ph.D., P.Eng. GeoAdvice Engineering Inc.</i> Co-presenter <i>Jeremy Sagebiel City of Powell River</i>	Removing nitrogen from high-strength effluent with anammox <i>Simon Vincent, B.Sc., M.Eng. Veolia Water Technologies Canada Inc.</i>	SCADA in Squamish: Zero to hero in ten years <i>Tom Green District of Squamish</i>
2:15 - 2:45 pm	Dynamic environmental monitoring networks: saving on lab costs versus keeping your regulator happy <i>Remi Allard, M. Eng., P. Eng. Piteau Associates Engineering Ltd.</i>	Leveraging technology in asset management: utilizing sewer system condition data in innovative rehabilitation work programming <i>Jude Rohan, MBA, P.Eng., MIAM, ISP City of Coquitlam</i>	Please stay on the line: Putting I&I on hold with SSO tanks <i>Andrew Boyland, P.Eng. Kerr Wood Leidal Associates Ltd.</i>	Automated reporting for water treatment & distribution systems <i>Zane Spencer, P.Tech.(Eng.) MPE Engineering Ltd.</i>	Duck weed - Friend or foe? <i>Pat Miller, Certified Operator Sun Peaks Utilities Co. Ltd.</i>	The right SCADA system design means maximizing functionality <i>Tom Dunn Opus DaytonKnight Consultants Ltd.</i> Co-presenter <i>Victor Wong Opus DaytonKnight Consultants Ltd.</i>
TOPIC	Stream 11: Resource Recovery & Reuse	Stream 10: Technology & Innovation	Panel Session: How to Build a Competent, Sustainable Workforce	Stream 3: Effective Utility Management	Stream 8: Infrastructure Renewal, Replacement & Upgrades	Stream 14: SCADA & Control Systems
3:00 - 3:30 pm	Recent developments in textile filtration enable high quality, compact wastewater treatment <i>Chris Howorth, P.Eng. Veolia</i>	Radar level measurement for the wastewater industry <i>Steve McCuskey, VEGA Americas</i>	How to Build a Competent, Sustainable Workforce. See full panel description on page 85. <i>continued to 4:30pm</i>	Forensic utilities - A perspective on meter cheaters, illegal connections, and theft <i>Deb Churko, ASCT Regional District of Nanaimo</i>	Lynden water treatment plant replacement – Design and delivery of a 30 mld surface water treatment plant for a high turbidity source water <i>Miles Yi, Ph.D. Stantec Consulting Ltd.</i>	Cost effective SCADA systems <i>Paul McRae, A.Sc.T. Trittech Group Ltd.</i>
3:30 - 4:00 pm	Introducing a novel highly efficient electromagnetic sludge pre-treatment system to enhance the City of Kelowna's proposed anaerobic digestion process <i>Ehssan Hosseini Koupaie, University of British Columbia Okanagan</i>	Efficient, simple to operate treatment upgrades for lagoons and mechanical plants using MBBR <i>Simon Vincent, B.Sc., M.ing., Veolia Water Technologies Canada</i>		A how to revising operational levels of service <i>Catherine Dallaire, P.Eng. Opus International Consultants (Canada) Ltd.</i>	Green infrastructure – The design and maintenance of community assets <i>Alex McBride, P.E., CFM, Parsons Corporation</i>	Electronic control options for automatic control valves <i>Clinton Smith, Singer Valve</i> Co-presenter <i>Jody Malo Singer Valve</i>



PANEL SESSIONS

<p>DATE: May 2, 2016 TIME: 9:45 - 11:15 am LOCATION: Fairmont Chateau Whistler, Frontenac C</p>	<p>Technology & Innovation – How to Manage Risk and Maximize Value Innovation can reduce risk, enhance resilience, and deliver significant value for utilities; yet, it can be challenging to implement new technologies or innovative processes in a sector where change happens gradually. How can utilities innovate while also ensuring safe, reliable systems that protect public health and the environment? Our panel of experts, representing utilities, technology suppliers, and consultants, will share their experiences deploying innovative technology solutions. The panel will discuss:</p> <ul style="list-style-type: none"> • What are the drivers for innovation within utilities? • What are the benefits and risks of innovation? How can risks be managed? • What are the barriers to adoption of new technologies? • How have utilities successfully implemented new technologies? What lessons can be learned?
<p>DATE: May 2, 2016 TIME: 1:45 - 3:15 pm LOCATION: Fairmont Chateau Whistler, Frontenac C</p>	<p>Professional Engineer and System Risk Management Plans: Conceptual Approach For Improving the BC Drinking Water and Waste Water System This session will present the latest developments toward a new approach for drinking water and wastewater management ensuring public health and environmental risks associated with water and wastewater facilities/systems are properly managed. Professional engineers with training in water and waste water have no formally recognized role in the current drinking water management regulatory system in BC. Recognition of their professional opinion within the regulatory structure will create several new relationships, and address a number of long standing issues. There are three critical issues that typify the need for a system risk management approach. A new 'work force' assessment has been completed and illustrates the need for human resource planning, training and recruitment. A new BC 'infrastructure assessment' illustrates the need for infrastructure planning and investment in drinking water and waste water. Finally, climate change illustrates the need for thinking of 'managing water' within the drinking water and wastewater within the watersheds where they exist. This workshop is targeted at the professional engineering community, and will address:</p> <ul style="list-style-type: none"> • What are the risks that impact drinking water and wastewater systems? • What is system risk management? • Who is responsible today for managing risk in our water systems? How is risk managed? • What is new the role of the engineering profession in managing system risk? • What are some changes that can improve the management of system risks?
<p>DATE: May 3, 2016 TIME: 10:15 - 11:45 am LOCATION: Fairmont Chateau Whistler, Frontenac A</p>	<p>Implementing Sustainable Service Delivery: Asset Management from Policy, Programs to Politicians Investment in infrastructure renewal is critical to ensuring safe, sustainable water systems in BC, yet more than half of British Columbians are not willing to pay more taxes for water and wastewater infrastructure upgrades. How can utilities and municipalities plan for infrastructure renewal in a way that gains support from elected officials and taxpayers? Asset management is an essential tool for evaluating risks, establishing priorities, and developing political and public support. Panelists representing local government staff and politicians, who are tasked with implementing asset management practices, will provide their insights into what works, what the challenges are and how to be effective. This panel will discuss:</p> <ul style="list-style-type: none"> • The benefits and risks of asset management • New tools designed to guide local governments in understanding and implementing asset management practices • Best practices to engage communities to embrace asset management • How senior levels of government are considering asset management plans in infrastructure funding decisions • How to build political and public support • Case studies of successful asset management planning
<p>DATE: May 3, 2016 TIME: 3:00 - 4:30 pm LOCATION: Fairmont Chateau Whistler, Frontenac B</p>	<p>How to Build a Competent, Sustainable Workforce A recent profile of BC's water and wastewater sector workforce indicates that in the next decade, over 3,200 new workers will be required in the municipal water and wastewater sector in British Columbia, to fill vacancies due to retirement, attrition, and industry growth. Over one-third of workers are over 50 years of age, and the sector has not attracted its share of women or younger workers. Employers have identified the need to establish standard industry competencies, provide a clear path to entry and advancement within the sector, and enhance access to training, in order to meet future workforce needs. During this interactive dialog session, participants will discuss:</p> <ul style="list-style-type: none"> • How to ensure that BC and Yukon has a competent, sustainable workforce. • How we can attract younger workers into the sector. • The importance of job competencies as a roadmap for career development and training. • What employers are doing to proactively prepare for workforce change. • What needs to change to provide a clear path of entry into the sector. • The similarities and differences between the public and private sector job market.



EDUCATION PROGRAM (Continued)

SMALL WATER SYSTEMS SYMPOSIUM

DATE: Monday, May 2

TIME: 9:45 am - 5:00 pm

LOCATION: Fairmont Chateau Whistler, Room Frontenac A

Do you support, manage or represent a small water system? If so, these are the presentations tailored with you in mind! Check out Stream 4 of the Education Program for SWS presentations.

SPONSORED BY



CROSS CONNECTION CONTROL SEMINAR

DATE: May 2, 2016

TIME: 9:45 am - 5:00 pm

LOCATION: Fairmont Chateau Whistler, Empress B

CCC Inspector Contact Hours: 6

The BCWWA will be holding a one-day CCC seminar on Monday, May 2 as part of the BCWWA Annual Conference & Trade Show in Whistler, BC. This professional development and networking event will include a demonstration and competition on backflow preventer disassembly and repair, as well as other topics relevant to CCC Testers, Inspectors, and Program Administrators.

Speakers will include:

- **Chris Twemlow** - Cross Connection Program Manager and Chair of the BCWWA's CCC Committee. Chris will present on the new City of Vancouver CCC Bylaw, recent backflow incidents in the City of Vancouver and other topics related to running a CCC program for BC's largest municipality.
- **Gavin Murgatroyd and Scott Benson** - CCC Program Official and CCC Inspector with District of Squamish. Gavin will tell the story of the development of the District's CCC program and Scott will speak on his role of conducting CCC inspections for the District.
- **Stephen Little** - Vancouver Airport Authority. Stephen will present on some of the unique situations and challenges related to the application of backflow protection that have come up for the airport authority.
- **Paul Allen** - BC Backflow Testing and Service. Paul will be sharing stories and advice on testing in the Lower Mainland and the role of the tester.

SPONSORED BY



TECHNICAL TOURS

Enhance your conference experience with a Technical Tour!

TECHNICAL TOUR: EXTENDING GLACIER LIFE ON BLACKCOMB MOUNTAIN

DATE: May 1, 2016

TIME: 12:00 pm - 2:30 pm

LOCATION: Whistler, BC

PRICE: \$69 member | \$89 non-member

Separate pre-registration required.

Municipalities and other water purveyors reliant on spring snow freshet in mountainous regions may want to consider artificial snowmaking as an alternative to building large surface water dams. This presentation and tour will provide introductory technical information to assist organizations in determining if this approach is suitable for their community.

Join the BCWWA at this informative presentation and tour including:

- An overview of Whistler Blackcomb's climate change response strategy.
- Details of Whistler Blackcomb's glacier maintenance initiative.
- The components, technology and challenges of Whistler Blackcomb's snowmaking system, including a snow-gun explanation and demonstration.
- A first-hand look at the Fitzsimmons Creek pump and hydro stations.
- Outcomes of the Whistler Blackcomb 2015/2016 snowmaking pilot program and future plans to ensure long-term resilience against climate change.

TECHNICAL TOUR: EPCOR BRITANNIA MINE WATER TREATMENT PLANT AND THE NATIONAL HISTORIC SITE BRITANNIA MINE MUSEUM

DATE: May 4, 2016

TIME: 10:00am - 12:30 pm

LOCATION: Britannia Beach, BC

PRICE: \$89

Separate pre-registration required.

Now a historic mine site in British Columbia, the Britannia Mine was a once an operational, large-scale copper mine in the early 1900's. When mining operations were at their peak, acid rock drainage became a significant environmental impact to surrounding waterways. Attendees will learn about the history of the mine, the significance of acid rock drainage and the heavy metal removal technologies used at EPCOR's Britannia Mine Water Treatment Plant, as part of remediation activities.

To learn more, please visit

www.bcwwa.org/conference-tours-workshops



OPERATOR PROGRAM

OPERATOR CHALLENGE: WATER WARS

DATES: Sunday May 1, 4:00 - 7:00 pm and Monday, May 3, 11:30 am - 1:00 pm

LOCATION: Whistler Conference Centre A challenge of skills, technique, knowledge, and dexterity, the BC Water & Waste Association (BCWWA) **Water Wars** brings operator teams together in the spirit of sharing knowledge and building skills! If you're visiting the trade show, this is one event you won't want to miss!

Teams of three operators will compete in three round robin events. The top three scoring teams will compete in a round of final Jeopardy (also known as Top Ops)! Scoring will be based on timing and skills.

Flush a metering pump for maintenance

Teams will need to conduct a flush of a metering pump in a confined space chamber.

Water main tapping

Teams will need to connect a water line to a live system pipe and test the connection.

Collection system

Teams will need to connect a four inch PVC lateral sewer line to an existing eight inch PVC sewer pipe.



WATER WARS



Final round - Jeopardy (top ops)

The top three scoring teams will compete in a round of final Jeopardy, answering questions related to EOC standards and operating procedures as well as WorkSafeBC regulations and practices.

Interested in competing?

Want to put your skills and knowledge to the test for the chance to win bragging rights as the top operators in BC and the Yukon, and slick winners-only apparel?

Visit www.bcwwa.org/conference-operator to register a team today!

OPERATOR TRAINING CIRCUIT

DATE: Monday, May 2

TIME: 2:00 - 4:00 pm

LOCATION: Fairmont Chateau Whistler, MacDonald Room

The BCWWA is pleased to introduce an Operator Circuit Program at the 2016 Annual Conference & Trade Show.

The program will feature a circuit of stations that **teach, demonstrate and/or allow participants to practice a skill, safety standard, best practice technique, or protocol** relevant to their work in water and wastewater services. Circuit presenters will present multiple instances of their "mini" educational sessions, so that participants have multiple opportunities to attend the session. [For more information, visit www.bcwwa.org/conference-operator.](http://www.bcwwa.org/conference-operator)

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OPERATOR RECEPTION

DATE: Monday, May 2

TIME: 4:00 - 5:00 pm

LOCATION: Fairmont Chateau Whistler, MacDonald Foyer

Following the Operator Circuit Program, operators are invited to attend the Operator Reception. The reception will include tabletop displays from presenting operator circuit organizations.

SPONSORED BY



WORKSHOPS

INFORMATION SESSIONS: GROUNDWATER LICENSING REQUIREMENTS AND GROUNDWATER PROTECTION REGULATION

DATE: Wednesday, May 4

LOCATION: Fairmont Chateau Whistler, Frontenac A

PRICE: Complimentary, separate pre-registration is required

The British Columbia Ground Water Association is pleased to be facilitating Ministry-led Information Sessions on new regulations now in effect under the Water Sustainability Act in conjunction with the BCWWA 2016 Conference and Trade Show.

These sessions will inform on the new Ground Water Protection Regulation and new requirements for Groundwater Licensing under the Water Sustainability Regulation.

Learn more and register at www.bcgwa.org





ACTIVITIES

Check out www.bcwwa.org/conference-receptions-activities for the latest information on conference activities!

TECHNOLOGY SHOWCASE

DATE: May 1, 2016

TIME: 4:30 - 7:45 pm

LOCATION: Whistler Conference Centre, Main Stage

Check out the newest products, technologies and services in the water and wastewater industry on the Trade Show main stage.

Main Stage SPONSORED BY



YOUNG PROFESSIONAL RECEPTION

DATE: Sunday, May 1

TIME: 6:00 - 7:30 pm

LOCATION: Whistler Conference Centre, Fitzsimmons Room, lower level

The 2016 YP Reception centers around the theme: "Resilient, Resourceful and Ready: Sharing Experiences in BC's Water Industry". The event features Pecha Kucha style presentations from young professionals and successful participants of the BCWWA Student Design Completion and will feature a keynote speaker from the water industry.

Please join us at the Young Professional (YP) Reception for an evening of compelling discussion and networking. All are welcome to attend.

SPONSORED BY



TRADE SHOW 'APPY HOUR'

DATE: Sunday, May 1

TIME: 6:00 - 7:00 pm

LOCATION: Whistler Conference Centre, Trade show floor

Mingle, network and connect with our Trade Show exhibitors during 'Appy Hour' on the Trade Show floor on Sunday evening.

SPONSORED BY



SCAVENGER HUNT

DATES:

Sunday, May 1: 3:00 pm - 7:00 pm

Monday, May 2: 10:30 am - 1:30 pm

LOCATION: Whistler Conference Centre

Join the hunt and enter to win a daily grand prize! Conference attendees will receive a scavenger hunt map in their pocket programs. Complete the scavenger hunt questions or activities correctly to enter the draw. Participating exhibitors hold the answers to the questions, so check out their booths!

SPONSORED BY



TRADE SHOW LUNCH & SHUTTLE SERVICE INFO

DATE: Monday, May 2

TIME: 11:30 am - 1:30 pm

LOCATION: Whistler Conference Centre, Trade show floor

Make your way to the Trade Show floor on Monday, May 2 for lunch with our exhibitors.

Trade Show lunch
SPONSORED BY:



Shuttle Service
SPONSORED BY:



Continuous loop shuttle service to Whistler Conference Centre and back.

AGM AND RECEPTION

DATE: Monday, May 2

TIME: 5:00 - 6:00 pm

LOCATION: Fairmont Chateau Whistler, Room Frontenac C

BCWWA Board Reception & Annual General Meeting

The BCWWA Board is hosting a reception in conjunction with 2016 Annual General Meeting (AGM). The AGM includes adoption of the minutes from the 2015 AGM, the President's Report, the audited Financial Statements, the CEO Operations Report, and the Elections Committee Report. Join us as we welcome incoming Board members.

BC Section of AWWA Annual General Meeting

The BC Section of AWWA Annual General Meeting takes place immediately following the BCWWA AGM. The agenda includes adoption of the minutes from the 2015 AGM, the Financial Statements and election of Directors and Officers. Information about the slate of candidates is available at www.bcwwa.org/annual-general-meeting. Nominations may also be made from the floor by BC Section members in good standing during the AGM.

CONFERENCE TABLETOP EXHIBITOR ORGANIZATIONS

DATE: Monday, May 2 & Tuesday, May 3

LOCATION: Fairmont Chateau Whistler

Check out the conference tabletop exhibits during the coffee breaks at the Fairmont Chateau Whistler in the Frontenac Foyer.

Tabletop exhibitors include:

- Environmental Operators Certification Program (EOCP)
- Metro Vancouver
- MHPM Project Managers Inc.
- Sapphire Water International Corp.
- Linestar Utility Supply Inc.
- McCue Engineering Contractors
- Filterco Water Treatment Ltd.
- Wachs Canada Ltd.
- Rollins Machinery Limited
- Mica Controls Ltd.
- Contech Engineered Solutions LLC
- Westburne
- Tecumseth Group Inc.
- H2Flow Tanks & Systems Inc.
- ECOfluid Systems Inc.

METRO VANCOUVER DOCUMENTARY SCREENING

DATE: Sunday, May 1, 2016

SCREENING TIMES:

3:30 pm - 4:00 pm; 7:00 pm - 7:30 pm

LOCATION: Whistler Conference Centre, Lower Level Rainbow Theatre

"Building of the Twin Tunnels"

For more than 10 years, Metro Vancouver video-documented the construction of one of the largest water



infrastructure projects in the world from breaking ground to final commissioning. This visual journey documents the underground trains, massive pipes, and detailed work of engineers who oversee the installation of enormous valves, pumps and chambers that will deliver Metro Vancouver's world-class water to residents.



TAP WATER TASTE TEST

DATE: Tuesday, May 3
TIME: 10:30 am - 12:00 pm
LOCATION: Fairmont Chateau Whistler, Frontenac Foyer

The BCWWA is hosting its third "Best of the Best" Tap Water Taste Test at the 2016 Annual Conference in Whistler, BC. Stop by the Frontenac Foyer and see if the City of Chilliwack can keep hold of their title, or if a new municipality will be crowned with the title of "Best of the Best" Tap Water in BC and Yukon. This is one event you won't want to miss!

Interested in participating?

British Columbia and Yukon drinking water providers are invited to submit a drinking water sample to be judged by a panel of "aqualiers" – water taste professionals.

See www.bcwwa.org/conference-receptions-activities for details on eligibility, sample requirements, and evaluation criteria. If you have questions, please contact Jodi Garwood at jgarwood@bcwwa.org.

BC WATER WEEK BOOTH

DATES: Monday, May 2 & Tuesday, May 3
LOCATION: Whistler Conference Centre
May 1-7, 2016 is BC Water Week! Stop by the booth to find out more about BC Water Week activities, subscribe to our newsletter, and sign the pledges to Conserve, Protect and Support our water resources and systems. All those who sign a pledge will be entered into a draw to win one of three Whistler weekend prize packages care of Tourism Whistler!

For more information on BC Water Week and how you can get involved, visit www.valueofwater.ca or contact Jodi Garwood at jgarwood@bcwwa.org.

Show your love for BC water at the pop-up photo booth and receive fun giveaways!

BC Water Week Photo Zone SPONSORED BY:



LUNCHEON + AWARDS

DATE: Tuesday, May 3
TIME: 11:45 am - 1:45 pm
LOCATION: Fairmont Chateau Whistler, MacDonald Room

BCWWA AWARDS

The BC Water & Waste Association (BCWWA) presents awards to recognize individuals and organizations for their outstanding achievements in the water and wastewater industry and for the commitment and support they provide to the BCWWA.

Awards are presented at Tuesday's Luncheon.

Luncheon SPONSORED BY



WATER FOR PEOPLE FUNDRAISING ACTIVITIES

DATE AND LOCATION:

Sunday May 1, 2016 at the Whistler Conference Centre;
Monday May 2 and Tuesday May 3, 2016 at the Fairmont Chateau Whistler

Stop by the Water for People Silent Auction to bid on treasures with all monies received supporting Water for People – Canada.

Learn about Water for People at www.waterforpeople.org/about/water-for-people-canada.

Pick up a pocket program onsite during the BCWWA Annual Conference & Trade Show for bidding deadlines and winning bid announcement information!

ROCKIN' RECEPTION!

DATE: Tuesday, May 3
TIME: 4:15 pm - 6:30 pm
LOCATION: Fairmont Chateau Whistler, MacDonald Room

Included in full conference, exhibitor upgrade, student, and one-day Tuesday pass types. Additional tickets available for purchase.

Join our rockin' reception on Tuesday with live music from renowned West Coast band 'Cease & Desist.' Celebrating their 25th anniversary, the band will be sure to get the party started! Sample delicious appies and beverages, meet the Whistler Brewing team, and celebrate the end of another fantastic conference!

SPONSORED BY



LOCAL INFORMATION

Be sure to visit the Tourism Whistler stations at the trade show or conference for Whistler visitor information, services and delegate deals available at local merchants.

SPONSORED BY:

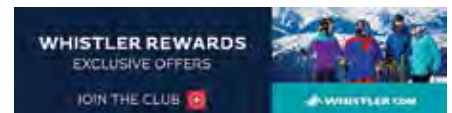


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- \$50 credit for every 5th night booked through us
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See www.bcwwa.org/conference-receptions-activities for more information and registration details.



RESOURCE ZONES

LOCATION: Whistler Conference Centre, Main Level Trade Show floor; and Fairmont Chateau Whistler, Frontenac Foyer and conference corridor

Looking for news and industry information? Want to learn more about a sponsor organization?

Pick up the latest brochures, a copy of the BCWWA's Watermark magazine and other reference materials with a visit to the conference and trade show Resource Zones.

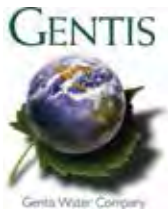
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RESILIENT,
RESOURCEFUL
& READY

SPONSORS

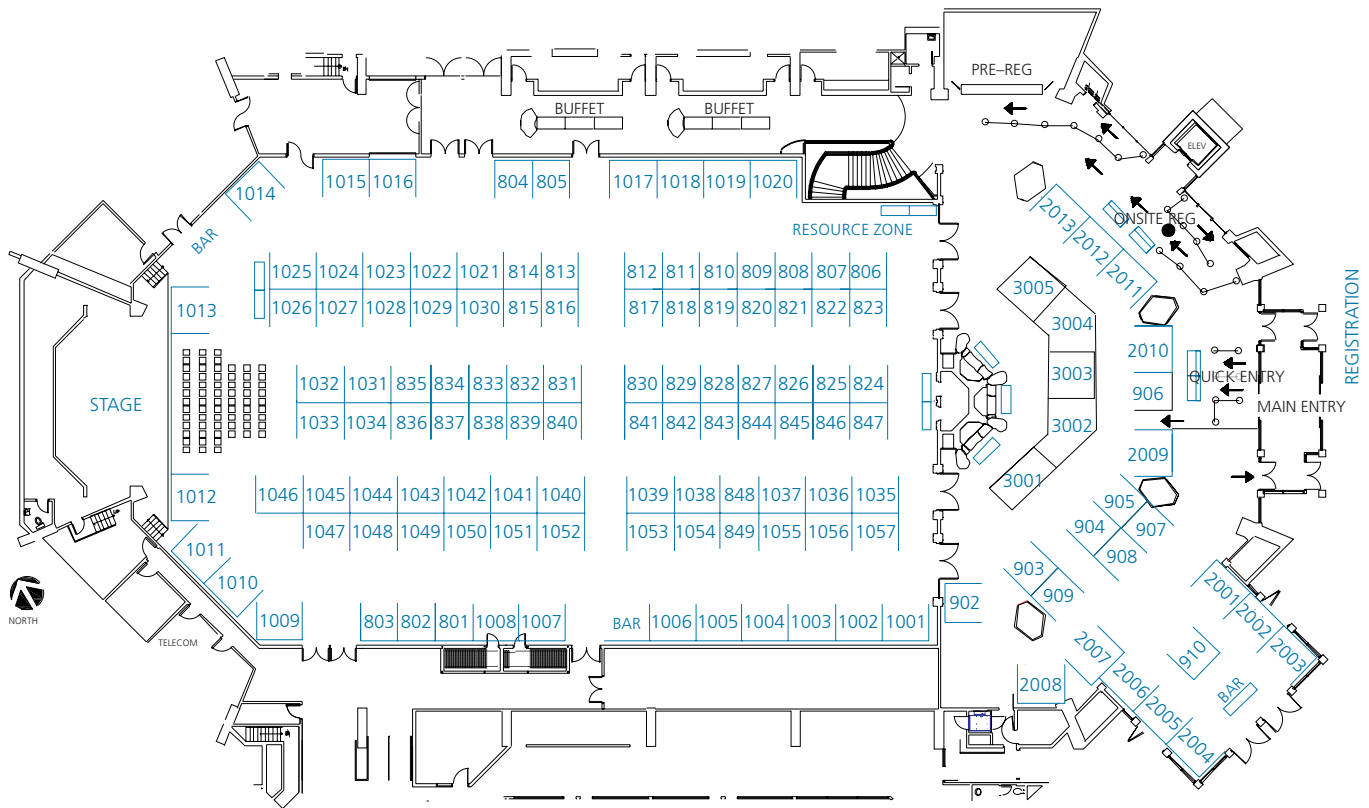


MEDIA PARTNER:





TRADE SHOW MAP



EXHIBITORS

Booth#	Exhibiting Organization
801	SFE Global
802	Celco Controls Ltd.
803	The Ford Meter Box Company
804	Unified Alloys
805	Hanley Agencies Ltd.
806	FluksAqua
807	Galaxy Plastics Ltd
808	WJF Instrumentation Ltd.
809	Kee Safety Ltd.
810	Fabco Plastics
811	Sanitherm
812	GAS Analytical Sytems Ltd.

Booth#	Exhibiting Organization
813	Robar Industries Ltd.
814	CUPE BC
815	Crystal Cam Imaging Inc.
816	Smith Cameron Process Solutions
817	Mueller Canada
818	Sensus / KTI Limited
819	Frank J. Martin Co.
820	Sulzer Pumps Wastewater Canada Inc.
821	Droycon Bioconcepts Inc.
822	EMCO Corporation
823	Target Products Ltd.
824	Northlands Water & Sewer Supplies Ltd.

Booth#	Exhibiting Organization
825	Alfa Laval Inc.
826	Hetek Solutions Inc.
827	Sherwin Williams
828	Kemira
829	Insituform Technologies Ltd.
830	Urecon Preinsulated Pipe
831	EECOL Electric
832	Westech Industrial
833	EST Environmental Technologies Ltd.
834	Mountainview Systems Ltd.
835	Filterpro Services Canada Ltd.
836	AutoSol



EXHIBITORS

Booth#	Exhibiting Organization
837	Primex Controls
838	Inland Divers Underwater Service Ltd
839	Nilex Inc.
840	Wolseley Waterworks Group
841	FLOCOR
842	BGE Service & Supply (The Filter Shop)
843	Coast Water
844	Predl Systems North America Inc.
845	Capital H2O Systems, Inc.
846	Kaesar Compressors
847	Clow Canada
848	Metercor
849	UA Piping Industry College of British Columbia
902	Chemline Plastics Limited
903	Birksco
904	Walsn Enterprises Ltd.
905	Northern Frontier Logistics LP o/a Central Water
906	USC Utility Supply (West) Corp
907	Victaulic
908	DN Tanks
909	JWC Environmental
910	Chamco Industries Ltd.
1001	Fred Surridge Ltd
1002	Neptune Technology Group Ltd.
1003	Kwantlen
1004	FortisBC
1005	Ipex Inc.
1006	Waste 'n WaterTech Ltd.
1007	Ramtech Environmental Products
1008	Vimar Equipment Ltd.
1009	Martech
1010	Pentair Water / F.E. Myers Canada

Booth#	Exhibiting Organization
1011	EP Engineered Pump Systems Ltd.
1012	Four Star Waterworks Ltd.
1013	Mar-Tech Underground Services Ltd
1014	United Rentals
1015	Procon Systems Inc.
1016	SUEZ Degremont
1017	Xylem
1018	ADI Process Solutions
1019	ADI Process Solutions
1020	ADI Process Solutions
1021	BI Pure Water (Canada) Inc.
1022	MPE Engineering Ltd.
1023	Pro-Line Fittings
1024	Pro-Line Fittings
1025	Hayward Gordon ULC
1026	ClearTech
1027	Canada Pipe Company Ltd.
1028	EJ
1029	Corix Group of Companies
1030	Endress+Hauser Canada Ltd
1031	Terminal City Ironworks Ltd.
1032	Summit Valve and Controls
1033	Cambridge Brass
1034	Simark Controls Ltd.
1035	DXP CANADA - NATPRO
1036	Armtec
1037	John Brooks Company Ltd.
1038	ROMAC Industries Inc.
1039	Opus DaytonKnight
1040	Gentis / UV Pure Technologies
1041	Gentis / Hydreka
1042	Guillevin Automation
1043	Mequipco Ltd.

Booth#	Exhibiting Organization
1044	IDEXX Water
1045	Brenntag Canada
1046	Delpro Automation Inc.
1047	Precision Service & Pumps Inc.
1048	E.B. Horsman & Son
1049	The Langley Concrete Group
1050	CTH Systems Inc.
1051	Star Pipe Products
1052	PBX Engineering Ltd.
1053	Canadian Dewatering Ltd.
1054	A.H. McElroy Sales & Service (Canada) Ltd
1055	DWG Process Supply Ltd.
1056	Waterhouse Environmental Services Corporation
1057	BowRio Water Technologies Inc
2001	Spartan Controls
2002	Con-Cur West
2003	Univar Canada Ltd.
2004	Sika
2005	DeepRoot Canada Corp
2006	Western Water and Gas Products
2007	Computrol
2008	Mearls Machine Works Ltd
2009	DFW Plastics, Inc.
2010	Andrew Sheret Limited
2011	Franklin Electric
2012	BC One Call
2013	SRP Control Systems Ltd.
3001	Veolia Water Technologies Canada
3002	Hach Canada
3003	Hydranautics - Nitto Group Company
3004	KSB Pumps Inc.
3005	Biomaxx



ANNUAL CONFERENCE HOTELS – BOOK NOW!

The Fairmont Chateau Whistler

4599 Chateau Boulevard, Whistler, BC V0N 1B4
www.fairmont.com/whistler/

Book by phone: 1-800-606-8244
or 1-800-441-1414

Online: <https://aws.passkey.com/event/13878843/owner/3631/home>

Group code: BC Water and Waste Association

Rates: Start at \$185.00 per night + applicable taxes and fees.

Cancellation: There will be no penalty when an individual cancels their guest room 31 days or more prior to arrival. If cancelled within 30 days of arrival, full room and tax will be charged to the credit card on file. No show reservations will be charged full room and tax.



OTHER CONFERENCE HOTELS INCLUDE:

Aava Whistler Hotel

4005 Whistler Way, Whistler, BC V0N 1B4
www.aavawhistlerhotel.com/

Crystal Lodge

4154 Village Green, Whistler, BC
www.crystal-lodge.com/

Delta Whistler Village Suites

4308 Main Street, Whistler, BC V0N 1B4
www.marriott.com/hotels/travel/ysewv-delta-whistler-village-suite/

Hilton Whistler Resort & Spa

4050 Whistler Way, Whistler BC V0N 1B4
www3.hilton.com/en/hotels/british-columbia/hilton-whistler-resort-and-spa-YWVRHF/index.html

Pan Pacific Whistler Mountainside

4320 Sundial Crescent, Whistler, BC V0N 1B4
www.panpacific.com/en/hotels-resorts/canada/whistler-mountainside.html

The Westin Resort & Spa Whistler

4090 Whistler Way, Whistler, BC V0N 1B4
www.westinwhistler.com/



For special BCWWA rates, group codes and more information on conference hotels, please visit www.bcwwa.org/conference-hotels

TRAVELLING BY BUS?

Transportation with Pacific Coach is available at a 20% discount for BCWWA delegates!

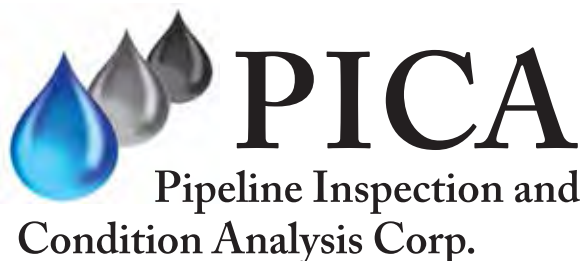
Routes include:

- Vancouver International Airport (YVR) to/from Whistler; and
- Downtown Vancouver to/from Whistler.

See www.bcwwa.org/conference-hotels for more information on conference transportation.

Advertiser Information

COMPANY	PAGE	PHONE	WEB SITE
Absolute Industrial Mechanical Ltd	17	604-460-2818	www.absoluteindustrial.ca
AECOM	66	604-444-6400	www.aecom.com
Aqua-Bility Projects Ltd.	8	250-826-2967	www.aqua-bility.ca
Associated Engineering Group Ltd.	IFC	604-293-1411	www.ae.ca
AWI (Antratech Western Inc)	21	866-755-7377	www.awifilter.com
BI Pure Water Inc.	62	888-882-6659	www.bipurewater.ca
BioMaxx WasteWater Solutions	9	855-940-5556	www.biomaxx.ca
BowRio Water Technologies Inc.	51	604-592-2464	www.bowriowater.ca
British Columbia Environmental Industry Association (BCEIA)	55	604-683-2751	www.bceia.com
Canadian Dewatering LP	29	604-888-0042	www.canadiandewatering.com
Canadian Union of Public Employees	30	604-291-1940	www.keepwaterpublic.ca
Capital H2O Systems, Inc.	44	403-251-2438	www.capitalh2o.com
Chamco Industries Inc.	51	604-513-8770	www.chamco.com
CLOW CANADA	60	604-807-6768	www.clowcanada.com
Coast Water Systems Inc.	39	604-460-3622	www.emcoltd.com
Corix Control Solutions LP	38	604-942-0288	www.corix.com/ccs
Delpo Automation Inc.	70	800-663-7220	www.delpo.net
Denso North America Inc.	4	416-291-3435	www.densona.com
DN TANKS	54	503-323-2000	www.dntanks.com
DWG Process Supply Ltd.	52	780-460-8433	www.dwg-process-supply.com
E.B. Horsman & Son	37	888-HORSMAN	www.ebhorsman.com
EDS Pumps & Water Treatment Ltd.	29	800-900-2220	www.edspumps.com
Engineered Pump Systems Ltd.	32,64	800-668-4533	sales@engineeredpump.com
Eramosa Engineering Inc	58	519-763-7774	www.erasosa.com
Franklin Miller	52	800-932-0599	www.franklinmiller.com
Gentis Water Company	74	604-536-5504	www.gentiswater.com
Hydro International	31	866-615-8130	www.hydro-int.com
Inland Divers Underwater Service Ltd.	33	250-801-2855	www.inlanddivers.com
Insituform Technologies	11	800-234-2992	www.insituform.com
IPEX Inc.	26	866-473-9462	www.ipexinc.com
J&S Valve	OBC	866-498-4283	www.jandsvalve.com
Kemira Water Solutions Canada, Inc.	20	800-465-6171	www.kemira.com
Kerr Wood Leidal Associates Ltd.	48	604-294-2088	www.kwl.ca
Koers & Associates Engineering Ltd.	58	250-248-3151	www.koers-eng.com
Kon Kast Products (2005) Ltd.	49	250-765-1423	www.konkast.com
Kwantlen Polytechnic University	65	604-598-6039	www.kpu.ca
Mar-Tech Underground Services Ltd.	58	604-888-2223	www.mar-tech.ca
McElhanney Consulting Services Ltd	50	604-683-8521	www.McElhanney.com
Mequipco Ltd.	22	800-663-9035	www.mequipco.com
Metercor Inc.	73	888-290-3070	www.metercor.com
Metro Vancouver	62	604-432-6200	www.metrovancouver.org
MSR Solutions Inc.	57	250-479-5164	www.msrsolutions.ca
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Netzsch Canada Inc.	64	705-797-8426	www.netzsch.com
Norske Corrosion & Inspection Services Ltd.	41	604-882-1818	www.norskecorrosion.com
Northlands Water & Sewer Supplies Ltd.	29	250-561-1884	www.northlandswater.ca
OPUS DaytonKnight Consultants Ltd.	8	604-990-4800	www.opusdaytonknight.com
Parsons Corporation	13	403-228-9450	www.parsons.com
Pembina Controls Inc.	6	877-736-2462	www.pem-controls.com
Pipeline Inspection and Condition Analysis Corp. (PICA)	IBC	800-661-0127	www.picacorp.com
PipeLogix Inc	72	866-299-3150	www.pipelogix.com
Piteau Associates Engineering Ltd.	10	604-986-8551	www.piteau.com
Ramtech Environmental Products	57	403-221-8585	www.ramtech.ca
Sapphire Water International Corp	43	800-205-3633	www.sapphire-water.ca
Sensus	70	800-638-3748	www.sensus.com
Smith & Loveless Inc.	7	704-844-1100	www.smithandloveless.com
SPARTAN Controls Ltd.	28	604-422-3700	www.spartancontrols.com
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UA Piping Industry College of British Columbia	57	604-540-1945	www.uapicbc.ca
Unified Alloys	74	604-607-6750	www.unifiedalloys.com
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Univar Canada Ltd.	56	604-273-1441	www.univarcanada.com
Urecon Ltd.	13	780-985-3636	www.urecon.com
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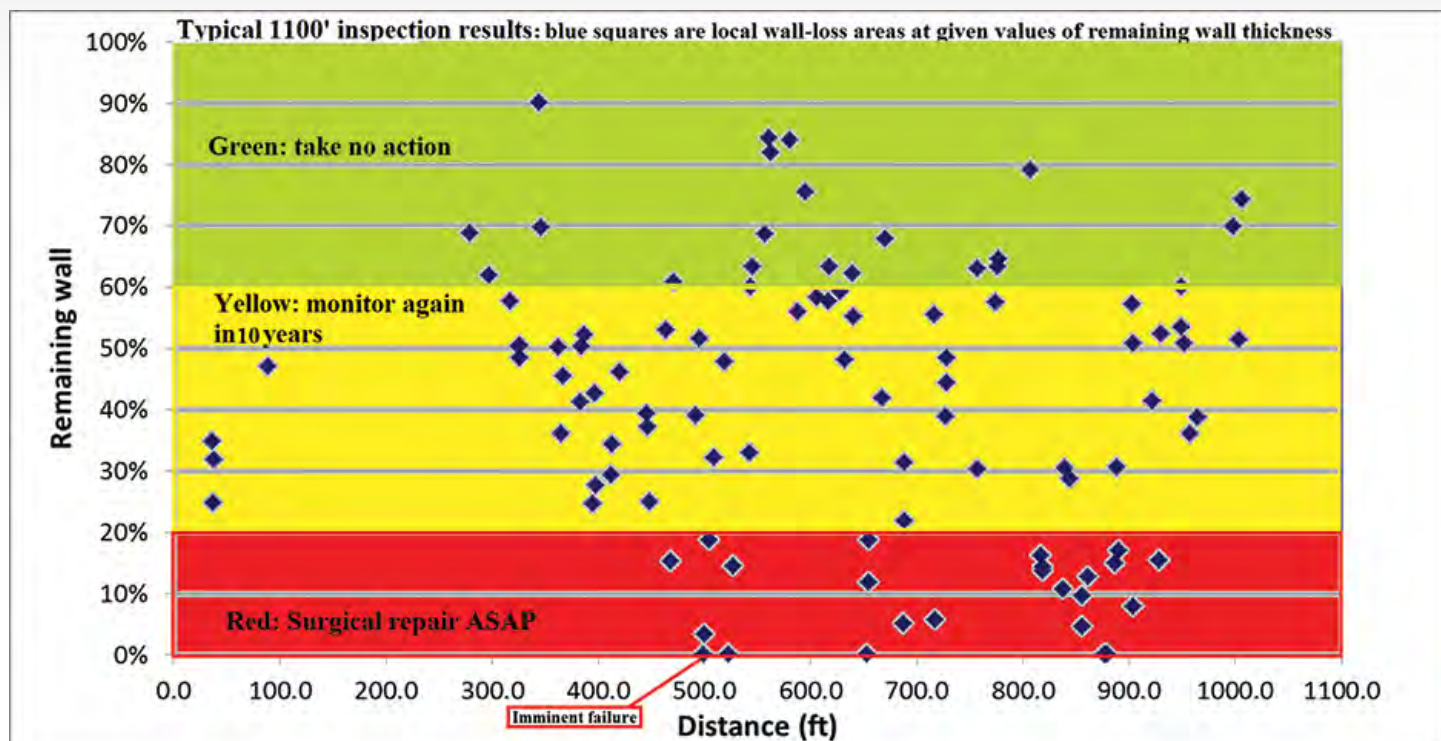
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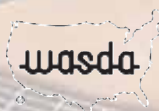
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