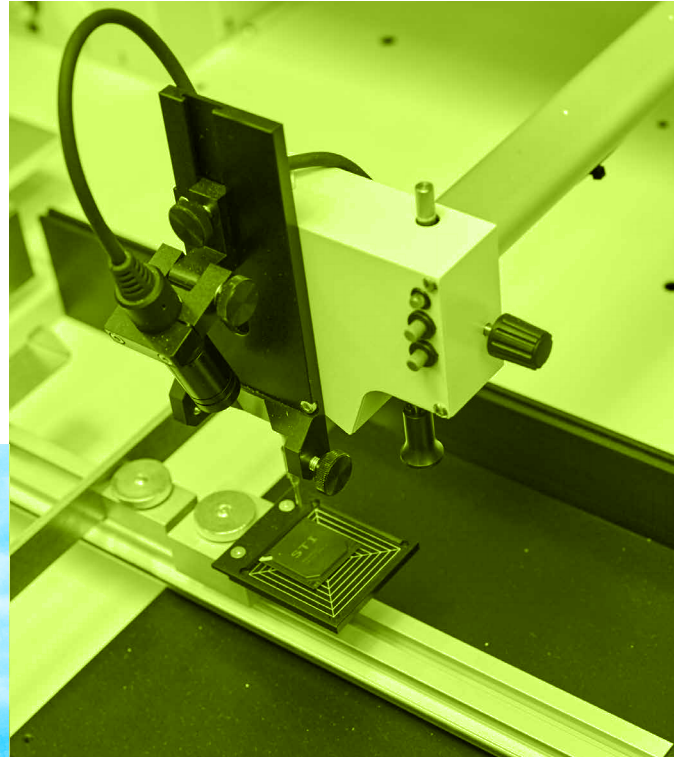


2016 IN REVIEW

SOUTHERN ONTARIO WATER CONSORTIUM



SOUTHERN ONTARIO WATER CONSORTIUM

LE CONSORTIUM POUR L'EAU
DU SUD DE L'ONTARIO

MESSAGE FROM THE EXECUTIVE DIRECTOR

A Year of Growth

The Southern Ontario Water Consortium believes innovation is necessary to solve water challenges. And innovations become marketable solutions when private sector and academic knowledge are applied in real-world environments. That's the reason we support and connect people, platforms, and ideas.

For SOWC, 2016 was a strong year that underlined the significance of this work.

We have renewed support for our mandate. In January, Prime Minister Justin Trudeau announced a commitment from Federal Economic Development Agency for Southern Ontario (FedDev Ontario) to fund up to \$12 million for R&D projects under SOWC's Advancing Water Technologies program. SOWC also received new funding from Ontario's Ministry of Research, Innovation and Science to support technology development and industry engagement related to biosolids reduction, resource recovery, or energy generation from wastewater.

The consortium continues to engage and support top research talent. SOWC's network of 10 world-class institutions and more than 400 researchers continue to benefit from the infrastructure and build new connections to industry.

The AWT program is a success. In 2016, SOWC awarded 14 innovative projects under the AWT program, including its first "large" project:



BRENDA LUCAS
Executive Director,
Southern Ontario
Water Consortium

an "energy-neutral" wastewater treatment project with GE Water & Process Technologies.

SOWC has enabled real-world demonstration. Use of the unique testing platforms has increased and we've helped companies connect with municipal infrastructure for technology development and demonstration.

SOWC is engaging stakeholders in critical dialogue.

Working closely with the Ontario Clean Water Agency and WaterTAP, SOWC hosted several significant events in 2016, including a consultation with Amarjeet Sohi, the federal Minister of Infrastructure and Communities.

In 2017, SOWC aims to continue this momentum. As the application process for AWT projects comes to a close in December, our goal is to approve more projects that focus on specific, real-world needs. We look forward to continuing to foster our academic network, collaborate with partners, and support the growth of the sector.



London's Greenway Wastewater Facility



A BRIEF HISTORY

In 2011, the University of Waterloo was the lead institution for a project to establish SOWC as a world-leading watershed scale platform for research, development, testing and demonstration of water technologies and services.

SOWC received funding from the provincial and federal governments, with contributions from member post-secondary institutions, the City of London and the City of Guelph, and a major matching contribution from IBM.

With these funds, the SOWC created and commissioned a suite of facilities in 2014. Since then, SOWC has attracted two new post-secondary institutions to its membership. In 2016, the organization received a new \$12-million funding commitment from FedDev Ontario to create the Advancing Water Technologies program.



Previous: Infrastructure at London's Greenway Wastewater Facility;

Above: Prime Minister Justin Trudeau and Hon. Navdeep Bains arrive at the University of Waterloo to announce new funding for the SOWC.

OUR STORY

SOWC is a catalyst for business-led collaborations in the Ontario water sector. It leverages unique physical assets for technology development and demonstration, and the water-related expertise of more than 400 researchers across its 10 world-class member post-secondary institutions.

SOWC is dedicated to advancing the commercialization of innovative water technologies through facilitating access to real-world testing facilities, introducing companies to academic expertise, and funding industry-led collaborative projects to develop and demonstrate new products and services.

Our Advisory Board includes representation of the vice-president of research (or designate) from each of SOWC's member post-secondary institutions, as well as partner organizations that include the Grand River Conservation Authority, the City of London, and the City of Guelph. SOWC also counts many experts among its advisors, who participate in the organization as members of the Platform Management, Industry Advisory, and Project Oversight committees.

"The SOWC was able to bring us high-quality researchers who already had a passion for what we are doing and were prepared to come in and critique our product, which is what was important to us. It's a tremendous opportunity to have a well-respected academic working with us."

– Kevin Bossy, CEO, Bishop Water Technologies

SOWC INFRASTRUCTURE BY THE NUMBERS



150+

PUBLICATIONS OR
OTHER RESEARCH
OUTPUTS RELATED TO
SOWC INFRASTRUCTURE



47

RESEARCHERS
RECEIVED FUNDING
RELATED TO SOWC
INFRASTRUCTURE

**“50+
CITATIONS**

RECEIVED FOR
PUBLICATIONS
RELATED TO SOWC
INFRASTRUCTURE

167 EXAMPLES

OF SOWC INFRASTRUCTURE AS A KEY RESOURCE
IN ACADEMIC RESEARCH PROJECTS

MAJOR MILESTONES

This year was a significant one for SOWC. Here are some of our major milestones.

-  **JANUARY:**
SOWC is awarded up to \$12 million in funding for three years from FedDev Ontario (see page 8 for more details), making it possible for SOWC to award 14 projects under the Advancing Water Technologies program in 2016.
-  **MARCH:**
Queen's University joins the consortium as a member.
-  **JULY:**
SOWC launches an Advancing Water Technologies program call for proposals to allow companies to apply for contributions up to \$500,000 for large projects.
-  **JULY:**
SOWC renews its MOU with the Ontario Clean Water Agency, in which the partners agree to work together to support the research, development, and demonstration of water technologies and practices and to provide strategic support to technology companies.
-  **NOVEMBER:**
SOWC expands the Advancing Water Technologies program to allow eligible companies to undertake more than one project.
-  SOWC was also awarded \$500,000 in funding from the Ontario Ministry of Research, Innovation and Science to leverage the FedDev Ontario funding and initiate a program to provide subsidies for a limited number of Ontario companies undertaking a development project for a technology related to biosolids reduction, resource recovery, or energy generation from wastewater. SOWC initiates the Value Generation from Biosolids Working Group.

Infrastructure at London's Greenway Wastewater Facility

PARTNER INSTITUTIONS



FUNDING ANNOUNCEMENT

On January 14, 2016, Prime Minister Justin Trudeau announced an investment of up to \$12 million in SOWC by the Government of Canada, through FedDev Ontario.

This investment enabled SOWC's Advancing Water Technologies (AWT) program to help Ontario companies leverage world-class research facilities and academic expertise to develop and demonstrate water technologies for successful introduction to the market.

This funding also helps SOWC to partner with businesses and not-for-profit organizations with the goal of increasing innovation and water-related collaborative projects.



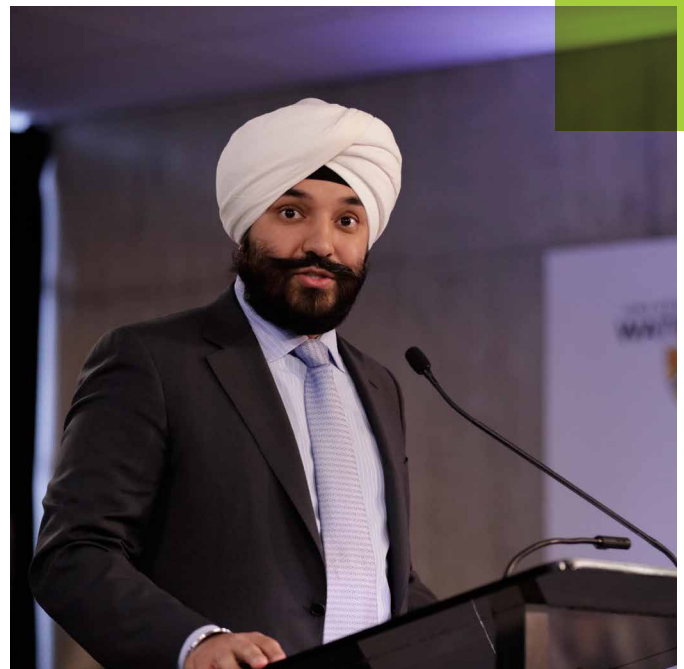
“We are immensely proud to be collaborating with like-minded partners on clean and innovative technologies. The partnership announced today between our government and SOWC will deliver health and economic benefits to the people of southern Ontario for years to come.”

– Rt. Hon. Justin Trudeau, Prime Minister of Canada



“Southern Ontario companies will have the opportunity to develop and accelerate the commercialization of new technologies in all areas of water and wastewater treatment and monitoring. This will make them stronger global competitors and grow local and regional economies in the process,” the Prime Minister said.

“Our government realizes the importance of investing in new groundbreaking companies and technologies. Canadians have long been international business leaders and skilled problem solvers. We can lead the world in clean technology development. By investing in groups like the Southern Ontario Water Consortium, we’re investing in our economy. We’re investing in our environment. We’re investing in our communities, but above all, we’re investing in our future.”



Above: Navdeep Bains, Minister of Innovation, Science and Economic Development.

Top: Brenda Lucas of SOWC poses with the Prime Minister, Minister Bains, the University of Waterloo’s President, Feridun Hamdullahpur, and Nancy Horsman, then President of FedDev Ontario.

Previous: Prime Minister Justin Trudeau.

ADVANCING WATER TECHNOLOGIES

Created and administered by SOWC, the Advancing Water Technologies (AWT) program is designed to enhance the Ontario water cluster and continue to build Ontario's reputation for water excellence around the world.

AWT helps small-to-medium enterprises in Ontario leverage world-class facilities and academic expertise to develop and demonstrate water technologies, providing financial contributions to industry-led R&D projects that will result in globally competitive and market-ready products and services. AWT supports existing industry-academic partnerships and actively encourages and develops new ones.

Since the launch of the program in 2016, SOWC has awarded funds for 14 projects (*see details in the following pages*). AWT will continue to accept projects throughout 2017. Projects must conclude by the end of 2018. Read more about program eligibility at sowc.ca.



MICROBIAL MONITORING

Industry Lead:

Genemis Laboratories Inc.

Member Institution(s):

University of Waterloo

Research Lead(s):

William Anderson

Project Title:

Real-time microbial monitoring system

Genemis Laboratories is developing rapid testing technologies for microorganism detection.

As part of this project, the company aims to develop an inline detection version of its existing technology, to be used for monitoring and control systems for drinking water quality.

This system will enable near real-time measurement of microorganism levels in water in treatment plants before or after treatment. It will not only allow operators to monitor the effectiveness of the treatment process, but also minimize the amount of energy and chemical consumption required for maintaining the water quality in accordance with the regulatory limits, and reduce over-treatment.

The project involves building a robust prototype that can be used for a pilot test in real-world conditions. It will also permit the optimization of the company's current test reagent composition to ensure robust and sensitive measurements for these conditions.



BIOSOLIDS MODELING

Industry Lead:

inCTRL Solutions Inc.

Member Institution(s):

McMaster University

Research Lead(s):

Younggy Kim

Project Title:

Development and validation of a model for the thermophilic pre-treatment of biosolids

Anaerobic digestion is an essential process in wastewater sludge treatment. Hydrolysis is one of the rate-limiting reactions in anaerobic digestion, but it can be greatly accelerated by increasing the operating temperature to 50°C or higher.

Temperature effects on the rate of individual biological reactions in anaerobic digestion have not been clearly explained, especially under thermophilic conditions. Consequently, commercial wastewater treatment models cannot provide reliable simulation results for anaerobic digestion under thermophilic conditions.

inCTRL Solutions and research partners will investigate kinetic constants for biological reactions, with an emphasis on hydrolysis reactions, in thermophilic pretreatment of wastewater sludge. In addition to sludge destruction reactions, the team will study the effect of temperature on E. coli inactivation in anaerobic digestion to produce safe and high-quality land fertilizers from wastewater sludge.

This insight will be incorporated in a commercial wastewater treatment modelling software package (SIMBA#) for broad applications of the findings in sustainable wastewater sludge treatment and management. Bioanode sensors for monitoring the performance of the thermophilic pretreatment system will be developed to monitor sensor process performance and provide inputs to a process control system. An existing software platform for monitoring and control will be further developed to provide data quality control, performance monitoring, and automated process control of thermophilic pretreatment systems.



NOVEL MBBR

Industry Lead:

H2FLOW Equipment Ltd.

Member Institution(s):

Fleming College

Research Lead(s):

Brent Wootton

Project Title:

Pilot installation to optimize performance of the TILT-MBBR-Ultrafiltration, an innovative technology for the treatment of municipal wastewater

H2FLOW Equipment Inc. has developed the TILT™-MBBR, a novel technology for the treatment of wastewater. The primary objective of this AWT project is a pilot installation to optimize the operation and design parameters of the system, such as media fill ratio, maximum treatability, biological load per specific surface of media, air optimization, as well as evaluate the feasibility of this technology for the treatment of wastewater.

Although many technologies are available to treat wastewater, there is still the need for a robust mobile system with the right balance between effluent quality, transportability, low maintenance, high oxygen transfer rate efficiency, and modular capability for higher flow rates. This project will develop a package system that embraces all of those aspects with the added benefit of having a small footprint and low energy consumption.

The results from this applied research will provide information required to optimize the TILT™-MBBR, determine its application and treatment efficacy for municipal wastewater, and expand it to industrial wastewater based on the pollution load.

LAGOON TREATMENT

Industry Lead:

Bishop Water Technologies

Member Institution(s):

Western University

Research Lead(s):

George Nakhla

Project Title:

Full scale BioCord demonstration project for cold temperature ammonia removal in wastewater treatment lagoon



Bishop Water Technologies' BioCord Reactor Treatment System. Copyright: Bishop Water Technologies

For many water technology companies, setting up a real-world demonstration that proves the effectiveness of a product to potential customers can be an uphill battle. But, thanks to SOWC and the AWT program, Bishop Water Technologies secured a demonstration site, ministry approvals, a relevant research partner and the funding required to demonstrate its fixed film BioCord Reactor technology.

Bishop's full-scale pilot demonstration project aims to improve the performance of active wastewater lagoons at a test site in the Township of Southgate in Dundalk, Ontario. One BioCord Reactor contains up to 1,500 square meters of looped cord and can be installed directly into the lagoon. The cords work by maximizing the surface area for existing bacteria to attach itself.

Having these modules means municipalities can easily upgrade the efficiency and capacity of their wastewater lagoons without costly infrastructure, says Kevin Bossy, CEO. Currently, there are a number of smaller municipalities across Canada with outdated lagoons that are no longer adequate because of increased development and recent, more stringent, changes to wastewater treatment standards.

In addition to connecting Bishop with the municipality, SOWC also helped the company navigate through the provincial approval process and find the ideal research partner: George Nakhla, an engineering professor at Western University and SOWC's wastewater node leader.

Nakhla's role will be to collect and analyze data during the pilot demonstration and verify the technology's effectiveness.

The two-year project will look at the technology's ability to maintain an active biomass in both summer and winter temperatures. Bacterial activity levels tend to drop during the colder months, which means there is a reduction in the breakdown of organics. So far the reactors' performance in cold temperatures has only been tested in the lab and in outdoor wastewater tanks. The demonstration will also help the company determine the most effective positioning of the reactors in the lagoon.

The company has grown from three to 11 full-time employees in the past few years. In 2016, it reported revenue growth of 15% over 2015. Bossy credits a supportive innovation ecosystem in Ontario, including assistance from the Water Technology Acceleration Project (WaterTAP). If this full-scale pilot is successful, Bossy expects much more significant increases in revenue in the coming years.

“Prior to connecting with the SOWC, we had already spent 18 months approaching municipalities to set up a demonstration site, but had not been successful. The SOWC is the reason we are at this stage now.”

– Kevin Bossy, CEO, Bishop Water Technologies

CONTAMINANT DETECTION

Industry Lead:

Environmental Bio-Detection Products Inc. (EBPI)

Member Institution(s):

University of Waterloo

Research Lead(s):

Simarjeet Saini

Project Title: Design and construction of portable detectors using fluorescent-based aptasensors for priority contaminant detection in water

EBPI has developed an aptasensor for the detection of priority pollutants in water. The company's AWT project will employ mobile signal sensing technologies to construct a portable, low-cost detector that uses EBPI's aptasensor for measuring target molecule concentrations.

Key objectives for the project include attaining relevant detection limits in field samples, making the prototype detector fully compatible with mobile devices including smart phones and tablets, exploiting computing power, optical sensors and GPS tags in these devices to impart additional capabilities like automatic data logging and contamination mapping, and designing an application to interpret and display the data for the user.

It is anticipated that successful construction of the detector will increase quality and efficiency of water testing at facilities in Ontario while providing a platform technology for future contaminants of interest. It will also diversify EBPI's current product portfolio, encourage expansion into new commercial areas, necessitate hiring of locally trained technical staff and increase sales of Ontario manufactured goods to foreign markets.

Industry Lead: A.U.G. Signals
Member Institution(s): University of Toronto
Research Lead(s): Ronald Hofmann
Project Title: Demonstration of an online photonic sensor to guide treatment changes to minimize disinfection by-products in drinking water

Like many other facilities, the water treatment plant in Smiths Falls, Ontario has experienced operational challenges in dealing with increased levels of trihalomethanes (THMs) as chlorine used in the disinfection process reacts with organic materials in water.

Temperature effects on the rate of individual biological reactions in anaerobic digestion have not been clearly explained, especially under thermophilic conditions. Consequently, commercial wastewater treatment models cannot provide reliable simulation results for anaerobic digestion under thermophilic conditions.

As part of the AWT program, Toronto-based A.U.G. Signals Ltd., is developing and testing an online photonic sensor at the plant. While the plant already monitors THMs beyond the minimum requirements, A.U.G.'s system will add real-time readings on an hourly basis using advanced sensing technologies. Both A.U.G. and University of Toronto researchers will monitor the data remotely and compare results to standard laboratory analysis of water samples. The project is scheduled to take 18 months.

A.U.G. is targeting a solution that would cost a fraction of gas chromatography systems, which can reach upwards of \$100,000, and won't require operation by specialized technicians. The A.U.G. unit is also designed to be the size of a small suitcase, and will use very little electricity.

A.U.G. agrees that the AWT program has many benefits. In addition to giving the company access to technical expertise and a research laboratory to validate its data, A.U.G. also believes the program will shorten the timeline for reaching full commercialization by up to one year.

"In order for innovation to reach municipalities in the public sector, I think it really requires something like AWT."

– Ron Hofmann, University of Toronto



A.U.G. Signals' system prototype to be tested at the Smith Falls water treatment plant during the AWT project. Copyright: A.U.G. Signals Ltd.

Industry Lead: Forward Water Technologies
Member Institution(s): University of Toronto
Research Lead(s): Vladimiros Papangelakis
Project Title: Validation and optimization of a pilot-scale proprietary Forward Osmosis process for industry wastewater treatment, recovery and reuse

Alongside researchers at the University of Toronto, Forward Water Technologies is working to accurately predict the economics of its technology at large commercial scale.

The Mississauga-based company has developed a new forward osmosis technology that uses engineered "switchable salts" to purify wastewater. It's a low-energy process for bulk cleanup of industrial wastewater streams and is aimed at alleviating the global demand for fresh water and reducing the volume of wastewater requiring treatment and disposal.

"The central project objective is to generate a global process model which can be used to validate and optimize our process economics," says Howie Honeyman, CEO.

Using data from Forward Water's mini pilot plant in Mississauga, chemical engineering professor Vladimiros Papangelakis and his team are working with the company on two main project components: fundamentals and industrial application, which involves setting up a chemical process optimization software model.

"[Our project with Forward Water] has been an excellent partnership. It is an outstanding training camp for the students."

– Vladimiros Papangelakis, University of Toronto

"We will be using fundamental information that we develop at UofT to provide value and for the parameters needed to run the software and predict the operations of the mini pilot plant," says Papangelakis. "By having a reliable model, which is fine-tuned and calibrated on real data, we will be able to expand the range of investigation and optimize the process."

The key objective is arriving at the optimum conditions that allow the process to run successfully using a minimum energy expenditure.

Founded by GreenCentre Canada, Forward Water is initially targeting the industrial and oil-and-gas production sectors, both of which can generate a significant amount of wastewater that must be transported and disposed of at a high cost. The aim is to enable the economical treatment of saline water while providing a fresh-water stream that can be recycled into operations.

As part of the AWT funding program, researchers are working to calculate the optimum amount of energy required to be applied in Forward Water's process. A winning case for the technology will be a process that meets the same water-cleanness standard of reverse osmosis processes with a lower energy expenditure, says Papangelakis.

"Once the reliable model identifies this optimum, this will allow Forward Water to prove unequivocally that the process is really operating under the minimum energy expenditure, meets the performance specifications, and even can be scaled up from the mini pilot size to a full plant size," he adds.

Industry Lead:

Greyter Water Systems

Member Institution(s):

Fleming College

Research Lead(s):

Brent Wootton

Project Title:

Development, optimization and validation of an innovative onsite water reuse technology to treat greywater



Greyter Water Systems Co-Founder John Bell with the Greyter HOME Solution. Copyright: Greyter Water Systems

After spending almost five years developing the key components of a new residential greywater-treatment system, Greyter Water Systems is in the home stretch of fine-tuning its technology.

"The process and components have been completed, and now we turn to field testing and final modifications before the rigorous six-month certification process," Mark Sales, co-founder and chief executive of Toronto-based Greyter, says of the company's new Greyter HOME water-recycling solution.

The final tweaks are being undertaken in collaboration with researchers at the Centre for Alternative Wastewater Treatment (CAWT) at Fleming College. The project involves evaluating, optimizing and validating the solution, which is designed to recycle shower and bath water to supply the water required for a typical household's toilet flushing. The technology has the potential to reduce indoor water consumption by 25-30%.

Thanks in part to the AWT funding program, Wootton and his research team are helping Greyter on its path to successfully commercializing the technology. In addition to a suite of scientists, engineers, technicians and technologists, the CAWT is providing expert knowledge on performance measures and quality assurance, and advanced research and lab facilities.

At a cost of around \$3,500 per unit, Sales says the system can be added to new homes without having a considerable impact on builders. It also fits within Ontario financial models for home-appliance rental markets, he adds. For builders in major markets like California, which Greyter considers a key area due in part to population growth, drought issues and a focus on sustainability, a small footprint was required in order to maximize the amount of livable space in new homes. Like other home appliances such as furnaces and water heaters, the Greyter HOME solution is also designed to require minimal maintenance by homeowners and service providers.

As for water quality, the solution is designed to meet a near-potable water-quality standard required in many major markets. In its collaboration with researchers at Fleming College, Greyter will soon put the technology through a stringent, six-month stress test for NSF 350 certification.

"AWT fills a void in the water-innovation sector, by helping bridge the gap of final development to full-scale launch. It's just been so timely for us."

– Mark Sales, Greyter Water Systems

INLINE DISINFECTION

Industry Lead:

Formarum

Member Institution(s):

University of Toronto

Research Lead(s):

Amy Bilton

Project Title:

Design and optimization of a Pico Hydro Turbine for inline water disinfection systems

The aim of this project is to design and optimize a miniature hydro-turbine for a self-powered water sanitizer (Dive) used for sanitizing swimming pools. The product has the potential to reduce chlorine consumption by up to 90%, reduce operating costs by up to 58% and decrease user maintenance time required by 75% when compared to a manually-chlorinated swimming pool.

The self-powered and self-contained design of the device is instrumental in ensuring it is easy to purchase and install for homeowners, especially when retrofitting into existing swimming pool systems. The key project activities will focus on improving energy efficiency and the operating range of the device.

The successful execution of these activities will culminate in the full-scale demonstration of an efficient and robust product, enabling Formarum to enter a large and expanding swimming pool market globally. The project also creates the means and the technical expertise to help the company quickly adopt its technology for secondary applications, including drinking water treatment systems.

ENGINEERED WETLANDS

Industry Lead:

Stantec Consulting Limited

Member Institution(s):

Fleming College

Research Lead(s):

Brent Wootton

Project Title:

Evaluation and assessment of the ability of an advanced engineered wetland to treat glycol de-icing and anti-icing fluids from airport wastewater streams

Airports face a unique challenge when attempting to treat wastewaters generated from de-icing and anti-icing activities during cold weather.

In response to concerns around the toxicity of these wastewater streams, manufacturers of aircraft de-icing fluids and anti-icing fluids (collectively referred to as ADAFs) began to alter the components of ADAFs, removing some components deemed toxic. In doing so, the formerly relatively stable ADAFs became biodegradable, and now contain increased amounts of phosphorus and nitrogen-based compounds.

This increase in nutrients has resulted in need for new methods to manage and treat glycol-contaminated streams to minimize the adverse effects on the environment where these streams are released. This project will assess the applicability of engineered wetlands as a marketable technology to treat glycol-contaminated runoff.

ORGANICS MONITORING

Industry Lead:

MANTECH Inc.

Member Institution(s):

University of Toronto

Research Lead(s):

Robert Andrews

Project Title:

Development of an oxidative organic monitoring tool for source and treated drinking waters

With funding from the AWT program, Guelph-based MANTECH Inc. and researchers from the University of Toronto are pilot testing a new technology at the Peterborough Water Treatment Plant.

Designed to measure oxygen demand (OD) and associated oxidative changes in organic matter on a near real-time basis, MANTECH's PeCOD is an online chemical oxygen demand analyzer for source and treated drinking waters. Currently, there are no real-time analyzers and few analytical techniques that are able to capture the oxidative changes of all organics in organic matter. MANTECH is looking to fill that void with the PeCOD.

Oxidative changes can be associated with later disinfection by-product formation, contaminant removal, and biofilm regrowth potential. Real-time analysis can help operators identify issues and change treatment tactics to produce better water and better protect public health.

At the pilot plant, values obtained from the PeCOD unit will be compared to routine water quality characteristics as well as more advanced analytical techniques. The partners expect the information collected will offer an improved measure of the changes in chemical reactivity of organics that occur as a result of biodegradation and oxidative pre-treatment processes.

In addition to MANTECH's collaborative efforts in the early stages of the project, Andrews says the support of the City of Peterborough has been invaluable. For him, the AWT program has allowed the right partners to align to help bring a new technology forward.

"It's the right collection of the right entities," he says. "To be successful you have to have an industry partner that's very receptive, a pilot plant where we're actually changing oxidative processes, and a very forward-thinking company like MANTECH all come together at the right time."

"AWT's support in helping bring new water technologies to market has also been crucial. These partnerships are critical. It's prohibitive as a small company to do it by ourselves. This is a great way to find very smart, knowledgeable research groups that can develop the experimentation and help us commercialize the technology."

— Robert Menegotto, President & CEO, MANTECH Inc.



MANTECH Inc. staff operating MANTECH's PeCOD technology. Copyright: MANTECH inc.

NUTRIENT RECOVERY

Industry Lead: Waterloo Biofilter
Member Institution(s): University of Guelph
Research Lead(s): Susan Glasauer
Project Title: Enabling recovery and reuse of nutrients with Waterloo Biofilter Residential Septic Systems

Waterloo Biofilter Systems Inc. is looking to fertilizer to help grow its innovative residential wastewater-treatment operations.

As part of a multi-pronged project with University of Guelph researchers, the Guelph-based company is planning to improve its onsite sewage treatment solution, studying the use of a unique filter material added to its electrochemical phosphorus-removal system as a possible soil nutrient.

"We're using a glassy silicate material, similar in appearance to fibreglass, to capture iron and phosphorus in our phosphorus-removal system, and are looking at reusing it as a fertilizing soil amendment," says founder Craig Jowett.

With the help of a team led by UofG professor Susan Glasauer, and the backing of the AWT program, growth trials are underway using the spongy, phosphate-laden material. Positive results have already been seen in trials with potted crops, where the material can be contained well, and a field trial is underway using rye grass.

Both Jowett and Glasauer agree that partnerships like theirs, with support from funding programs such as AWT, are a win-win for all parties.

"I think people outside the country don't realize the extent to which Canadian researchers depend on industry and these partnerships," Glasauer says, adding that working with Jowett has been particularly rewarding since "he's a researcher at heart and understands the need to do things in a rigorous way."

Ultimately, Glasauer says she'd like to see Waterloo Biofilter's systems implemented on a wider scale. "To see these being installed and seeing the ecosystems rebound — I think that would be amazing," she says.



Waterloo Biofilter's anaerobic digester, Shed Biofilter, and disposal bed.
Copyright: Waterloo Biofilter Systems Inc.

NUTRIENT MONITORING

Industry Lead: Honeywell/ComDev International
Member Institution(s): University of Toronto
Research Lead(s): Elodie Passepourt
Project Title: A novel Raman-based sensor for cost-effective monitoring of nitrate and phosphate in water

Monitoring water pollutants is critical for the protection of environmental health and the safe production of drinking water. This project will evaluate the performance of a novel water sensor for the detection of nitrate and phosphate, two nutrients responsible for river and lake eutrophication.

The sensor, a type of Raman Fourier Spectrometer, is a portable instrument capable of the simultaneous analysis of multiple pollutants in water. Thanks to an innovative detection and readout scheme, this sensor is designed to enable in situ continuous monitoring of pollutants in wastewater and drinking water treatment plants, as well as natural environments.

Current practices in wastewater treatment plants involve daily sampling of water samples and analysis in a laboratory to determine nitrogen and phosphorus concentrations. In contrast, the Honeywell sensor allows for identifying potential problems and adjusting the treatment process quickly.

The objective of this project is to evaluate the performance of the sensor under a wide range of environmental conditions. The wide adoption of this sensor by water treatment plant operators and environmental field engineers will allow for the most appropriate remediation methods to be implemented sooner in contaminated flows. The unit will be tested at a local treatment plant. The use of the sensor in wastewater treatment facilities will lower nutrient concentrations, thus decreasing the risk of eutrophication in lakes, improving ecosystem health, and decreasing costs of wastewater treatment operation by helping to optimize the treatment process.



ENERGY NEUTRAL WASTEWATER

Industry Lead:

GE

Member Institution(s):

University of Guelph,
McMaster University

Research Lead(s):

Sheng Chang, Younggy Kim

Project Title:

Valuation and full-scale demonstration of the Biological Hydrolysis Anaerobic Digestion (BH-AD) and ZeeLung™ MABR technologies for energy neutral wastewater treatment

“By working with SOWC and the Universities of Guelph and McMaster on this pilot, we are gathering critical data to improve energy recovery and bring new technology to market.”

– Glenn Vicevic, Product Management Executive, GE Water & Process Technologies

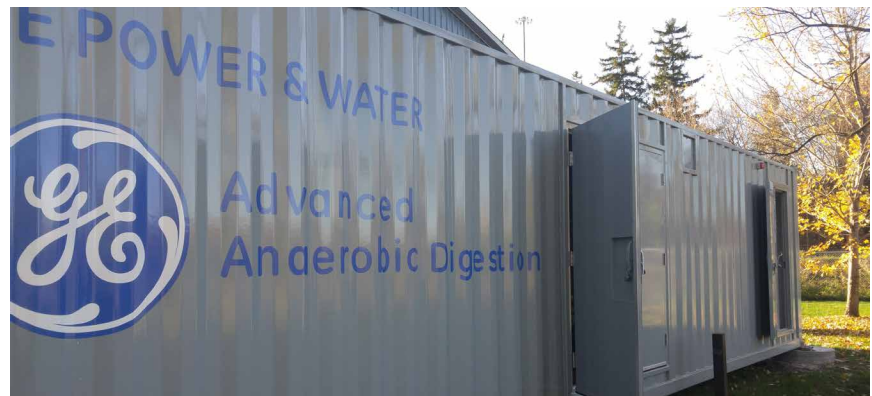
The project will support GE's demonstration and commercial release of a complete “energy neutral” solution for wastewater treatment by enhancing energy efficiency and recovery and resource recovery. The project has commenced and will continue through December 2018.

There are four components to GE's integrated solution which, deployed together, will achieve energy neutrality by both reducing demand and recovering energy from biogas: 1) advanced primary treatment with LEAPprimary™, 2) low energy, membrane-based carbon and nitrogen removal with ZeeLung™, 3) advanced anaerobic digestion with biological hydrolysis pretreatment to improve digester biogas yield, and 4) energy recovery with a combined heat and power Jenbacher gas engine.

Components 1 and 4 are commercially available. The project will allow GE to optimize the ZeeLung™ (component 2) and advanced anaerobic digestion (component 3) technologies for this application.

A team that consists of researchers from the University of Guelph, McMaster University, and GE Water and Process Technologies will work collaboratively throughout this project. The success of this project will help GE to commercialize the BH-AD and ZeeLung MABR technologies and apply these two important waste-to-energy technologies to the North American markets.

The applications of these technologies will help Ontario's municipalities to balance their wastewater treatment budget, producing positive economic, environmental and social impacts on Ontario's communities.



GE's pilot system being used for the project at the SOWC Guelph Wastewater Pilot Facility.

WORKSHOPS & EVENTS

SOWC hosted and participated in several events in 2016, including two workshops and eight outreach sessions at partner institutions.

ROUNDTABLE: SUSTAINABLE INFRASTRUCTURE JUNE 24 • TORONTO

The Government of Canada is investing \$120 billion over the next 10 years into an infrastructure plan that aims to address the gaps in infrastructure across Canada. Phase 1 of the plan is already underway and includes a new \$2-billion Clean Water and Wastewater Fund for provinces, territories and municipalities for immediate improvements to water distribution and treatment infrastructure.

In the summer, the federal government had just launched Phase 2 of this funding, and begun the process of consulting the public for input. In response, SOWC, OCWA and WaterTAP partnered to host a session for water leaders to present four strategic recommendations to Amarjeet Sohi, the federal Minister for Infrastructure and Communities.

The recommendations call for bold new vision for investments, and a shift in the way the government implements infrastructure funding so that it better supports innovation and growth while fostering financial and environmental sustainability, resilience, economic growth, and new jobs.

The group presented a strong message that the federal government should develop and implement this major investment in critical infrastructure to position Canada as a world leader in implementing the most efficient, robust approaches to water management and resource recovery.





FOUR KEY RECOMMENDATIONS

These are the four recommendations that the group presented to Minister Sohi. Read a detailed report of the roundtable and recommendations at sowc.ca.

➔ ONE

Create a dedicated program to help municipalities optimize and get the most out of their existing assets.

➔ TWO

Create a dedicated funding program to help municipalities implement projects to increase capacity or performance with non-traditional approaches.

➔ THREE

All major infrastructure funding programs must include criteria that prioritize sustainability and resilience and encourage and support innovation.

➔ FOUR

Adopt wastewater regulations that set clear expectations that support the bold vision the government puts forward.

WORKSHOP:
GETTING TO NET ZERO
MARCH 22 • LONDON

WORKSHOP:
**MOVING TOWARD
SMART WATER IN
ONTARIO**
NOVEMBER 30 • TORONTO

This year, SOWC partnered with the Ontario Clean Water Agency (OCWA) and the Water Technology Acceleration Project (WaterTAP) to host workshops to address two key topics: efficient water and energy use, and the integration of “smart” or digital technology into water management.

The first workshop, titled [Getting to Net Zero](#), asked participants to identify the specific actions or changes that are needed to transform wastewater treatment to “water resource recovery” in Ontario. It also asked stakeholders to think about how innovative approaches and technologies could play a role in this transformation.





The second workshop, [Moving Toward Smart Water in Ontario](#), engaged companies, municipalities and researchers to think about how new “smart” tools and technologies are helping water utilities extend asset life, reduce energy and water use, and provide better client service. It led participants through a visioning exercise to characterize current conditions in the water sector, and to outline a set of desired outcomes for Ontario’s future “smart” water sector. What would it take for us to get to that point?

For documents that summarize each workshop’s outcomes, as well as related priorities and messages, visit sowc.ca. We look forward to continuing these critical conversations in 2017 and working with partners to advance these priorities.



ROUNDTABLE: **WATER INNOVATION** APRIL 29 • TORONTO

Sponsored by Innovation, Science and Economic Development Canada, FedDev Ontario, and the Ontario Ministry of Economic Development and Growth, the Water Innovation Roundtable encouraged participants to exchange views on pathways – both technological and non-technological – for industry and government to seize opportunities associated with the water technology sector. At the meeting, participants identified success factors for industry and discussed concrete initiatives that could contribute to advancing it. SOWC was pleased to be invited to participate.

DATA PLATFORM WORKSHOP WITH IBM SEPTEMBER 6 • WATERLOO

In collaboration with IBM, SOWC hosted a data platform event to seek feedback from potential end users and collaborators to explore opportunities and potential applications of the watershed data streams and the data platform. In 2016 the SOWC Data Platform was converted to run in IBM's new Bluemix environment, enabling more flexibility and applications for end users.

CANADIAN WATER SUMMIT JUNE 23 • TORONTO

Since 2009, the Canadian Water Summit has served as a collaborative forum for leaders from diverse sectors to share insights and further a united mission: to build a sustainable water future for Canada. This year, SOWC's Executive Director, Brenda Lucas, was invited to chair the summit. Other guest speakers included Amarjeet Sohi, federal Minister of Infrastructure and Communities, as well as Glen Murray, Ontario Minister of the Environment and Climate Change, and federal Parliamentary Secretary, MP Jonathan Wilkinson. The summit focused on water as a critical resource (and risk) for industry and business.

ONTARIO WATER INNOVATION WEEK

OCTOBER 17-21 • TORONTO

Along with WaterTAP, SOWC was proud to be a partner in presenting the first-ever Ontario Water Innovation Week, which brought more than 300 leaders to Toronto from around the world. Anchored by two major conferences, Water Innovation in Action 2.0 and World Water-Tech North America, the week focused on topics that were both regional and global in scale. SOWC's Brenda Lucas participated as a panelist and moderator throughout the week, and also served on the advisory committee for Water Innovation in Action.

Clockwise from right: Michelle Brownlee, Smart Prosperity Institute; David Szeptycki, York Region; Hon. Michael Chan, Ontario Minister of International Trade. Copyright: WaterTAP.



The first-ever
Ontario Water
Innovation week
brought more
than 300 leaders
to Toronto from
around the world.

OUR FACILITIES

Along with its partner institutions, SOWC has created an integrated platform of state-of-the-art facilities for the research, development, testing and demonstration of water technologies. For complete descriptions of each facility, please visit sowc.ca.



GUELPH WASTEWATER PILOT FACILITY

(UNIVERSITY OF GUELPH):

The Guelph Wastewater Pilot Facility is a bench and pilot-scale facility constructed adjacent to the City of Guelph's municipal wastewater treatment plant. The facility offers unique testing capacity for treatment technologies by providing direct access to municipal wastewater at flow rates up to 300 m³/day.



SENSOR FABRICATION FACILITY

(MCMASTER UNIVERSITY):

This facility enables the development of automated, wireless, and distributed sensing of pathogens, chemicals, and elemental contamination. The platform provides infrastructure to design, prototype, and validate sensors.



LONDON WASTEWATER FACILITY

(WESTERN UNIVERSITY):

This facility is located at the City of London Greenway Wastewater Treatment Facility. It creates unprecedented capacity for compliance testing and demonstration of technologies, enabling access to full-scale municipal flows from 1000 m³/day up to 4,500 m³/day indoors.



WATERSHED MONITORING FACILITY

(UNIVERSITY OF WATERLOO):

State-of-the-art monitoring sensors and equipment are installed within the Alder Creek Watershed and Hopewell Creek Watershed in the Regional Municipality of Waterloo. Similar capacity is installed within the Mimico Creek Watershed in the City of Toronto, led by University of Toronto.



Infrastructure at London's Greenway Wastewater Facility



DATA INTEGRATION PLATFORM

(UNIVERSITY OF WATERLOO):

With a primary focus on the sensor data available through the Watershed Monitoring Facility, the SOWC data platform allows for real-time data manipulation and visualization through built-in graphical and reporting tools. Through the Bluemix environment, the platform has access to IBM analytical services and worldwide weather data, uniquely positioning SOWC to work with clients and partners to develop new and innovative applications.



DRINKING WATER FACILITIES

(UNIVERSITY OF TORONTO, UNIVERSITY OF WATERLOO, WILFRID LAURIER UNIVERSITY):

Multiple facilities are available for testing technologies that address emerging concerns in water treatment and effective use and reuse of water. They include mobile advanced oxidation process equipment, a mobile membrane pilot plant, and capacity for pathogen resilience characterization. In addition, the mobile ecotoxicology facilities at Wilfrid Laurier University and the innovative analytical techniques facilities at the University of Waterloo are ready to support associated activity.



NEW PARTNER FACILITIES (FLEMING COLLEGE AND QUEEN'S UNIVERSITY):

Fleming College's Centre for Alternative Wastewater Treatment comprises six outdoor research test cells and 20 ponds, an indoor pilot testing research facility and environmental chamber, and accredited analytical laboratory. Queen's facilities include a Coastal Engineering Laboratory, which is the largest university hydraulics laboratory in the country. The university is also home to the Queen's University Biological Station, and, in conjunction with CMC Microsystems, recently launched the Kingston Nano-Fabrication Lab.



SOUTHERN ONTARIO WATER CONSORTIUM

LE CONSORTIUM POUR L'EAU
DU SUD DE L'ONTARIO

SOUTHERN ONTARIO WATER CONSORTIUM

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POST-SECONDARY MEMBERS



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