

## **MEMORANDUM**

TO: Committee of the Whole

FROM: Erin Mahoney, Commissioner Environmental Services

DATE: November 14, 2013

RE: **Update on Research and Innovation in Water and Wastewater**

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This memo provides an update to Report No. 8 of the Environmental Services Committee, October 18, 2012.

### **Environmental Services has a very active research and innovation program for water and wastewater**

The goal of the Environmental Services Department research and innovation program is to align with Federal and Provincial initiatives, as well as with research conducted by United States Environmental Protection Agency (USEPA) and World Health Organization (WHO). The intent of the program is to use research and innovation to protect public health and the environment, understand emerging challenges, optimize facility operations to reduce chemical consumption and align with a complex and changing regulatory framework. The Environmental Services Department has ongoing partnerships with the Natural Sciences and Engineering Research Council (NSERC) of Canada Industrial Chair in Drinking Water Treatment at the University of Toronto, the Drinking Water Research Group and the Water Research Foundation. Partnership with the Drinking Water Research Group was renewed in April 2012 for an additional five years. The annual subscription to the Water Research Foundation was renewed in February 2013. Outreach to WaterTAP, the Southern Ontario Water Consortium and the Centre for Alternative Wastewater Treatment on potential areas of collaboration is ongoing. Additional smaller projects with universities and industry experts are also underway.

### **City of Toronto and Regions of Peel and Durham are also partners with Drinking Water Research group**

The City of Toronto and Regions of Peel and Durham recognize the importance of research and are partners in the University of Toronto Drinking Water Research Group. This promotes collaborative approaches to water and wastewater system operations and strengthens

communication between York Region and its key service delivery partners. Continued knowledge sharing provides learning opportunities for staff to enhance operational planning and practices and optimizing service delivery.

### **Integration of research and innovation into projects and programs improves facility operations, prolongs the lifespan of our assets, and enhances treatment quality**

Internally, research and innovation work has informed plant operations and capital upgrade proposals. For example, an evaluation of the granular activated carbon (GAC) at the Georgina Water Treatment has shown the filters are operating very effectively to reduce disinfection by-products. Potential savings of \$350,000 will be realized by the current GAC operating strategy requiring GAC to be replaced at a reduced frequency. In the area of energy efficiency, Keswick Wastewater Pumping is the most efficient pumping station in the Region since a pump replacement demonstrated 40 to 50 per cent electricity savings.

### **Leveraging partnerships with research and industry leaders has led to many successful projects and programs**

Some recent highlights from 2012 and ongoing project work include:

- Quantitative Microbial Risk Analysis
  - Evaluates treatment process effectiveness against measured pathogens in the raw water source. Project into second phase and used to manage risk, optimize plant operations and align with Federal and Provincial studies and future potential regulatory requirements. Regions of Durham and Peel, as well as the City of Toronto are project participants.
- Biologically Active Filtration
  - At the Georgina Water Treatment Plant, granular activated carbon bio-filters are effectively reducing disinfection by-products by up to 40 per cent. Disinfection by-products are regulated by the Province.
- Free Chlorine Conversion and ongoing residual decay studies
  - Use of models and control of distribution disinfection levels as well as innovative monitoring and best practices promoted success of this advanced drinking water distribution system maintenance and monitoring program.
- Showcasing Water Innovation project to investigate the removal of micropollutants from wastewater at the Keswick Water Pollution Control Plant. Jim Bradley, Minister of the Environment attended the facility July 30, 2012 to promote the project and its importance to Lake Simcoe and the Lake Simcoe Protection Plan

Future work will include:

- Partnering with City of Toronto throughout the pilot and implementation stages of their corrosion control plan
- Working with university researchers to explore the application of titanium oxide to water treatment for effective removal of organics, including emerging contaminants

Benefits of the research and innovation program include protecting public health and the environment, understanding emerging challenges, optimizing facility operations to reduce chemical and energy consumption and aligning with a complex and changing regulatory framework.

For a complete list of the current and future water and wastewater work please see the Projects and Programs Relating to Water and Wastewater Research and Innovation (*Attachment 1*).

Staff participation continues at industry events promoting the Region's leadership in water and wastewater programs, as well as ongoing communications with government agencies and industry. Improved knowledge, successful partnerships, and leveraging innovation enable the Region to anticipate and respond to future regulatory changes. All research and innovation efforts demonstrate the Region's commitment to continuous improvement, leadership, and operational excellence.

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Erin Mahoney, M. Eng.  
Commissioner of Environmental Services

LM/BB

Attachment

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**Projects and Programs Relating to Water and Wastewater Research and Innovation**

| <b>Project</b>  | <b>Partners</b>  | <b>Facility or Area</b>                             | <b>Brief Description of Project</b>   |
|---|--|---|---|
| Advanced water distribution systems monitoring technologies           | LuminUltra, Town of Newmarket, King Township, Town of East Gwillimbury | Newmarket, East Gwillimbury, Georgina, Schomberg    | Adenosine Tri-Phosphate monitoring enables the rapid quantification of biological activity in a distribution system. This test method has been recognized as an operational tool by the Ministry of the Environment based on work conducted by York Region.                             |
| Alternate neutralization chemical for membrane clean in place process | University of Waterloo   | Keswick Water Pollution Control Plant               | Pilot work to evaluate calcium thiosulfate as a chlorine neutralization chemical. Results revealed that substituting this chemical will result in the same membrane cleaning efficiency with lower Health and Safety risk to staff.   |
| Biologically Active Filtration for water treatment                    | University of Toronto Drinking Water Research Group                    | Georgina Water Treatment Plant                      | Granular active carbon is being recognized industry wide as the best host material for biological filtration. At the Georgina Water Treatment Plant, carbon is effectively reducing disinfection by-products by up to 40%. Further study will look at optimizing this treatment method. |
| Phosphorus/Nitrogen Adsorption Study                                  | Wilfred Laurier University, University of Waterloo                     | Offsite – lab sized pilot                           | Pilot study looks at the potential to remove nutrients from wastewater via adsorption. The treatment process if proven could evolve into a method for harvesting the phosphorus. This project supports the Lake Simcoe Protection Plan efforts.   |
| Titanium Oxide Nanowire filtration water treatment                    | University of Toronto, University of Waterloo, Trojan UV               | Offsite – lab sized pilot                           | Treatment of various emerging contaminants is very challenging. This project will look at the effectiveness of nanowire filtration for treatment of pharmaceuticals and disinfection by-products.   |
| Online Elevated Tank Inspections and Cleaning                         | PM Makar   | Hub 5: Kleinburg Elevated Tank                      | Inspection and cleaning are an important maintenance tasks for elevated tanks. Being able to clean a tank while it is online reduces risk and promotes water quality.   |
| Emerging Contaminant Characterization of Wastewater Effluent          | Trent University, Ministry of Environment                              | Sutton and Mt. Albert Water Pollution Control Plant | Use of samplers to characterize emerging contaminants (e.g. pharmaceuticals) in wastewater influent and effluent thereby determining plant removal efficiencies.  |

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|---|--|---|---|
| Free Chlorine Conversion  | Stantec Consulting Inc., Towns of Newmarket and East Gwillimbury             | Hub 3 – Newmarket Yonge/Green Lane water system | Use of an operational model and control of secondary disinfectant dosing, as well as enhanced monitoring and best practices.  |
| Georgina Water Modelling and Annular Reactor Study                    | Town of Georgina, Stantec Consulting Inc.                                    | Georgina and Keswick water systems              | Development of a full pipe hydraulic and water quality model. Combined with results of an Annular Reactor study model results assisted in predicting disinfection by-product concentrations and residual decay to aid in enhanced water system maintenance. |
| Newmarket Annular Reactor Study                                       | Stantec Consulting Inc.  | Newmarket and Queensville well supplies         | Bench scale project emulating a distribution system to evaluate water age, residuals and effects of maintenance practices.  |
| CT Calculator for Disinfection  | Stantec Consulting Inc., University of Toronto Drinking Water Research Group | Keswick Water Treatment Plant                   | Evaluation of current CT (CT being the disinfectant concentration multiplied by the contact time) practices plus implementation of a real time CT calculator. Will assist staff in demonstrating compliance during regulatory inspections.                  |
| CT-Computational Fluid Dynamic Study of Keswick Water Treatment Plant | University of Toronto Drinking Water Research Group                          | Keswick Water Treatment Plant                   | Analysis of flow paths to better determine disinfection effectiveness and to identify opportunities for increased efficiency with respect to dosage (chemical usage).   |
| Granular Activated Carbon source water matching                       | University of Toronto Drinking Water Research Group                          | Keswick and Georgina Water Treatment Plants     | Using Rapid Small Scale Column tests filter influent was matched to optimal Granular Activated Carbon for effective removal of taste and odour causing compounds (e.g. Geosmin, 2-Methylisborneol).   |
| Biosolids Haulage Reduction   | University of Waterloo   | Nobleton Water Pollution Control Plant          | Determining optimal thickening of biosolids at wastewater facilities reduces haulage costs and optimizes treatment processes.   |

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|--|--|---------------------------------------|---|
| Quantitative Microbial Risk Analysis   | University of Toronto Drinking Water Research Group, Water Research Foundation, Tetra Tech                       | Georgina Water Treatment Plant        | Raw water sampling of pathogens coupled with Health Canada's risk assessment model to enable prediction of risk.  |
| Removal of Micropollutants from Municipal Wastewater: Lake Simcoe/ York Region Pilot Project | Ministry of the Environment, University of Toronto Drinking Water Research Group, Calgon Carbon: UV Technologies | Keswick Water Pollution Control Plant | To evaluate the feasibility from a financial, energy footprint and treatment process perspective of using advanced oxidation to remove trace substances from wastewater effluent.     |
| Investigations into chloramine residual decay and stability                                  | University of Toronto Drinking Water Research Group  | All of the York Water System          | Investigations into complex water chemistry involving blending of surface and ground waters to provide a chloramine secondary residual.   |
| Use of Ferrate for water treatment   | University of Toronto Drinking Water Research Group  | Keswick Water Treatment Plant         | New cost effective methods to produce ferrate initiated an evaluation of the chemical's ability to serve as a coagulant at the Keswick Water Treatment Plant.                         |
| Open Source Reporting Tool for SCADA data (eSCADAr)  | Eramosa  | All areas                             | Open source code used to interface with data collection server to produce trends and tables of water and wastewater system data. System facilitates data sharing and better analysis. |
| Energy Efficiency Programs   | In house   | All areas                             | Realize significant returns on energy saving through optimization of existing facilities.   |