4th Annual
First Nations Water Research Conference
JUNE 1 & 2, 2017

From a photo by Aimee Craft

Robson Hall, University of Manitoba

CREATE H2O

University of Manitoba
Centre for Human Rights Research

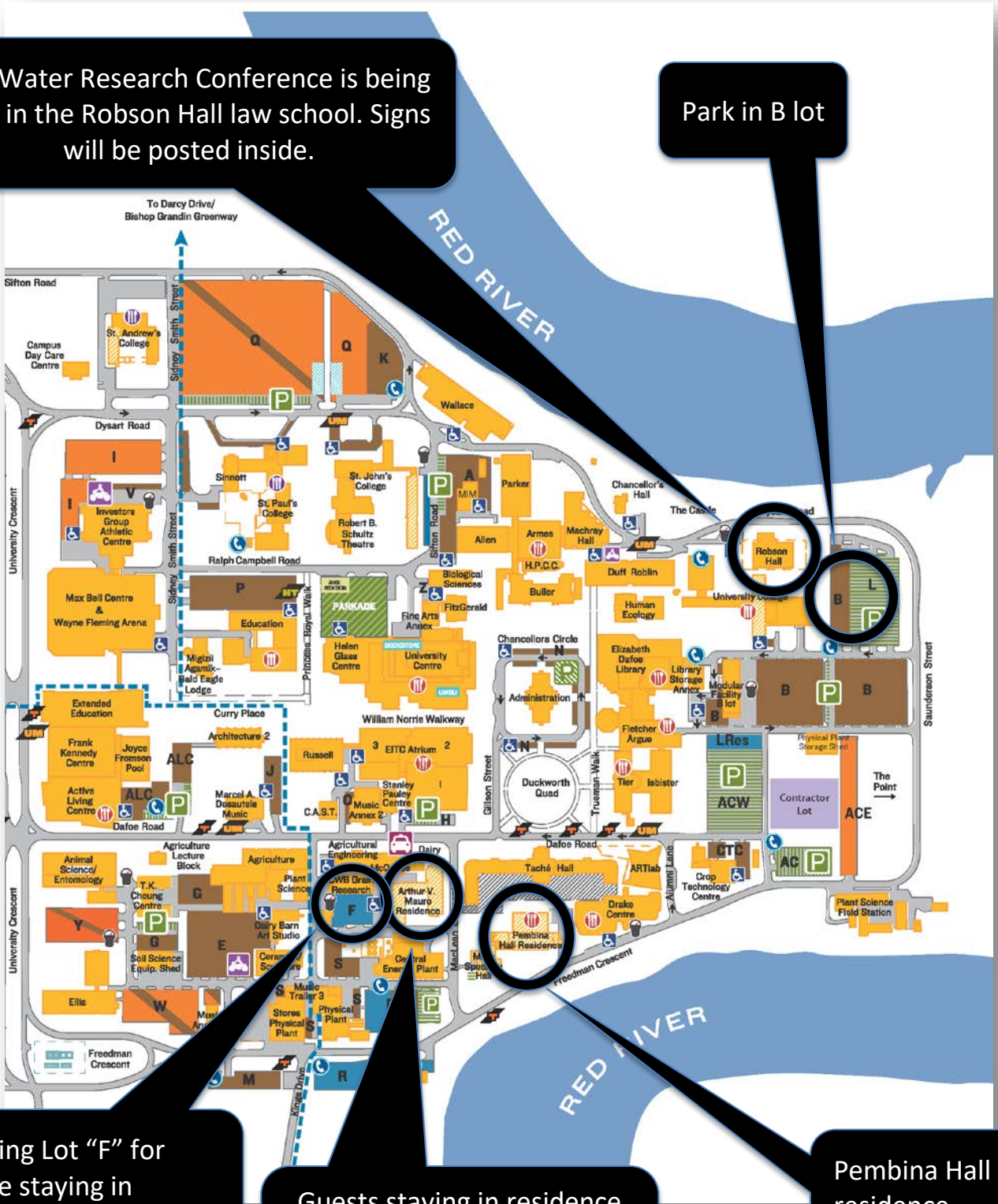
Trent University

Conference map

University of Manitoba – Fort Garry Campus

The Water Research Conference is being held in the Robson Hall law school. Signs will be posted inside.

Park in B lot

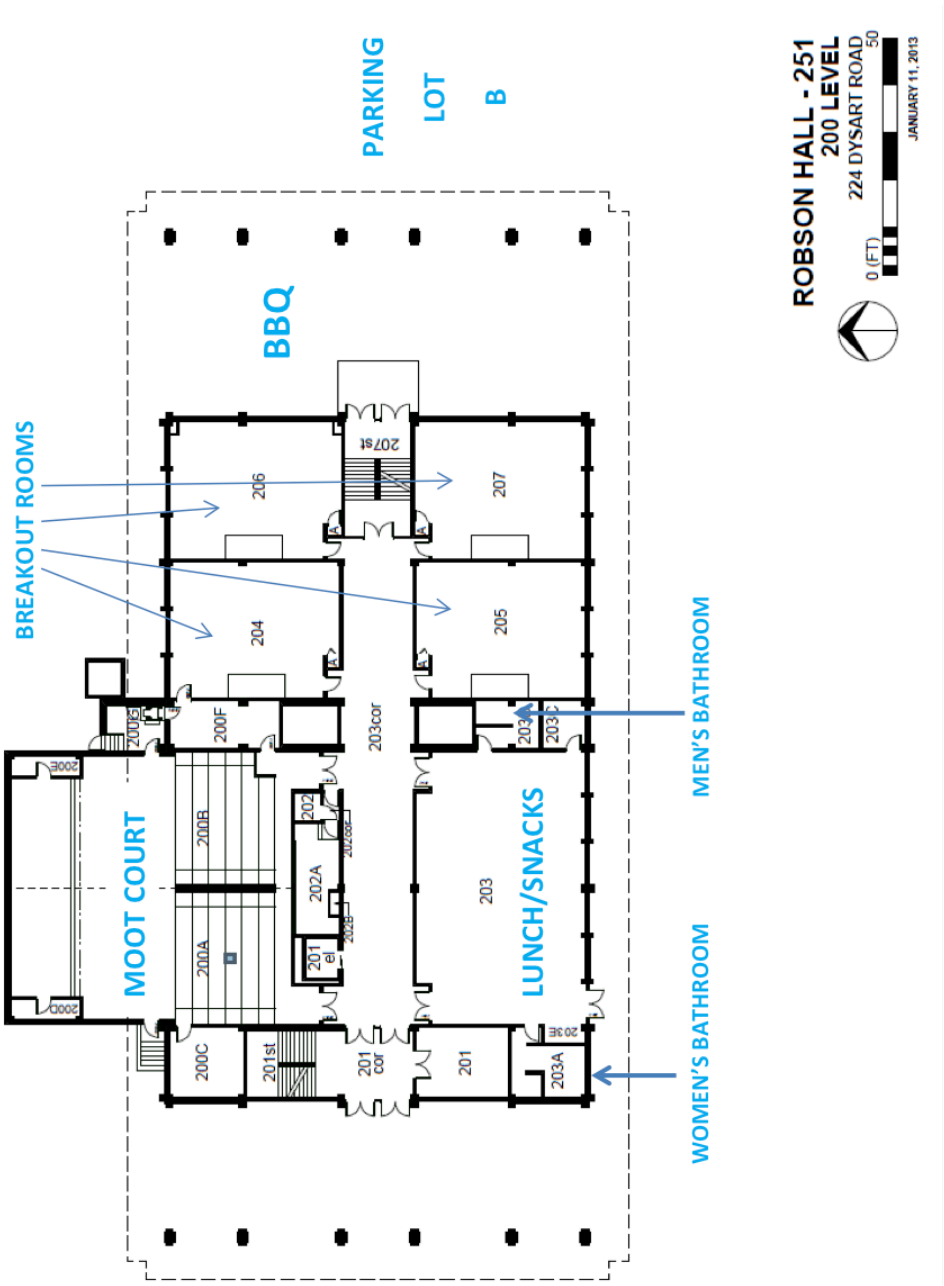


Parking Lot “F” for those staying in residence

Guests staying in residence must check-in/out at Mauro residence. Check-out before 10 a.m.

Pembina Hall residence accommodation

Floor Map of Robson Hall



AGENDA

Thur. June 1, 2017	
	In Moot Court, unless otherwise specified (Robson Hall)
8:30 - 9 a.m.	Registration (hallway) and coffee (Common Room)
9 - 9:30	Elder's opening prayer – Marlene Kayseas H2O director's remarks – Dr. Annemieke Farenhorst *MCs: students Kristy Anderson (MSc) and Taylor Morriseau (BSc)*
9:30 - 10:15	**Dr. Priscilla Settee**, University of Saskatchewan *Water: our First Relative, our First Responsibility*
10:15 - 10:45	Break (Common Room)
10:45 - 12:15 p.m.	**Drinking Water and Wastewater** Craig Murray – Contaminants of emerging concern Erin Hayward – Ozonation pre-treatment of wastewater Prof. Selvin Peter & Danielle Garrioch – Activated carbon Ruidong Mi & Tina Kitchkeesick – E. coli and antibiotic resistance genes *Chair: Warrick Baijius (PhD student, U Sask)*
12:15 - 1:15	Lunch (Common Room)
1:15 - 2:45	**Sediment and Pesticides** Mary-Claire Buell – Contaminated sediments Mauli Isuruni Gamhewage & Anita Murdock – Pesticides in water Johanna Theroux – Tracing sediment sources David Lobb – Sediment and dams *Chair: Diane Adams*
2:45 - 3:15	Break (Common Room)
3:15 - 4:15	**Tips from the Experts**: Heather MacKenzie, Neegan Burnside; Diana Nicholson, Nelson River Construction; Jordan Gardner, Eagle Lake; Audrey Brass, Pine Creek FN; Johanna Theroux, Lake Winnipeg Indigenous Collective *Moderator: Trevor Phillips, Indigenous Grad Student Coordinator*
4:15 - 5	Poster viewing
5 p.m.	BBQ (patio)

Fri. June 2, 2017	
	In Moot Court, unless otherwise specified
8:30 - 9 a.m.	Registration (hallway) and coffee (Common Room)
9 - 9:45	**Dr. Lalita Bharadwaj**, University of Saskatchewan *From the Lab to the Reserve: The Transformative Power of Community-Engaged Scholarship*
9:45 - 10:15	Break (Common Room)
10:15 - 11:30	**Risk** Leslie Collins – Source water protection planning Diane Adams & Russ Head – Drinking water risk communication Sarah Warrack – Microplastics in Lake Winnipeg *Chair: Mary-Claire Buell*
11:30 - 12:30 p.m.	Lunch (Common Room)
12:30 - 1:30	**Advocacy** Rayanna Seymour – Responsibilities to Nibi Prof. Katheryn Starzyk – Issue framing Raymond Harper – Costs of inaction Prof. Karen Busby – Evaluating strategies *Chair: Erin Hayward*
1:30 - 2	Break (Common Room)
2 - 4	**Breakout workshops** 1) Indigenous Knowledge, hydro and mapping – Victoria Grima, Claire Herbert and Elder Jackson Osborne, Room 206 2) Food security and water – Tim Stevenson, Room 207
4 - 4:15 p.m.	Closing remarks (H2O co-ordinator Wendy Ross) & evaluation form

INVITED SPEAKERS

Dr. Priscilla Settee is a faculty member in both Indigenous studies and women's and gender studies at the University of Saskatchewan, and a member of Cumberland House Cree Nation. She shares her expertise in Indigenous science knowledge, including about traditional foods, with people around the world. In 2013, Settee was awarded the Queen Elizabeth Diamond Jubilee award for her contributions to Canada.

Dr. Lalita Bharadwaj is committed to finding solutions and understanding issues associated with inequitable access, supply and provision of safe, sustainable drinking water supplies for First Nations, rural and remote Saskatchewan communities. Through her community-based participatory research activities, she has provided learning opportunities for university and local students, facilitated interdisciplinary research collaborations and helped build research capacity at the local and university level. Bharadwaj is a toxicologist at the University of Saskatchewan with expertise in human and environmental health risk assessment, including on brownfield sites impacted by creosote, polyaromatic hydrocarbons, and heavy metals.

PRESENTATIONS

Communication of Adverse Water Events for First Nations: Toward a Community-Based Drinking Water Risk Communication Framework

Diane Adams (MPH student, University of Saskatchewan)
Russ Head (Mistawasis First Nation)

While risk and crisis communications are a key aspect of effective emergency response, such communications can also be ineffective, or even harmful, if not conducted appropriately. Such negative outcomes become amplified for environmental health events that involve many complex stakeholder relationships, as has been the case for First Nations water management, thus verifying the need for new approaches. To improve water advisory risk communication, we also need to understand perceived risk. For instance, the connection between culture and risk perception of adverse water events for First Nations is intrinsically linked to the value placed on water in Indigenous cultural worldviews. This presentation outlines this background, providing the rationale for a participatory research mixed-method study into rethinking communication of drinking water advisories at the intersection of First Nation community and Tribal Council governance.

Ecotoxicological Risks from PAHs Released from Contaminated Sediments in Owen Sound Bay, ON, Canada

Mary-Claire Buell (PhD student, Trent University)
Prof. Ken Drouillard (Great Lakes Institute for Environmental Research, University of Windsor)

Prof. Chris Metcalfe (Institute for Watershed Science, Trent University)
Sediments in the inner harbour of Owen Sound Bay on Lake Huron are contaminated with polycyclic aromatic hydrocarbons (PAHs) and other inorganic and organic compounds. Given plans to dredge the harbour, used by the Saugeen Ojibway Nation (SON) for their traditional fisheries, we are evaluating the levels and distribution of PAHs and other contaminants and characterizing their toxicity to early life stages of fish. Concentrations of total PAHs in sediments in the inner harbour were well above the sediment quality guidelines for Ontario, with mean ∑PAH concentrations at the most contaminated site of 9,400 µg/kg dry weight. Using semi-permeable membrane devices (SPMDs), we found concentrations above provincial water quality guidelines for several PAH compounds in the water column. We exposed early life stages of two species of fish, Japanese medaka (*Oryzias latipes*) and lake whitefish (*Coregonus clupeaformis*) to extracts from the SPMDs. A high proportion of the medaka developed yolk sac edema. The whitefish did not show the same response, but these fry are being evaluated to determine whether they show more subtle toxicological effects. These data indicate that there is cause for concern that PAHs and other contaminants could be released by dredging activities in amounts sufficient to cause toxic effects in fish.

More Than Fact Sheets: How to Ensure that Water Rights Research Turns into Action

Prof. Karen Busby (law, University of Manitoba
Raymond Harper (St. Theresa Point First Nation)
Prof. Katherine Starzyk (psychology, University of Manitoba)
Rayanna Seymour (law student, U of M)
Community and university-based researchers have been working together on how to get people to care about clean drinking water and sanitation in First Nation communities. A Faculty of Elders is explaining relations with and responsibilities to care for water; other legal experts have provided frameworks to assert rights violations; social scientists and community members have evaluated the effectiveness of different messages describing the problem; and number-crunchers have considered how to make plain the financial and human costs of failing to deal with this problem. This panel will focus on how to bring together these research strands and how community members and others can to use the research in ways that can effect real change.

Source Water Protection Planning in an Ontario First Nation Community: A Case Study for developing a Community-based Source Water Protection Plan in M'Chigeeng First Nation.

Leslie Collins (Institute for Watershed Science, Trent University)
Craig Murray (Institute for Watershed Science, Trent University)
Stephanie Allen (Ontario First Nations Technical Services Corporation)
The Institute for Watershed Science at Trent University partnered with the Ontario First Nations Technical Services Corporation (OFNTSC) to work with the Ontario First Nation of M'Chigeeng to pilot the development of a cost-effective community SWP plan. The

pilot project used aspects of both the Ontario Source Water Protection framework and the AANDC (now INAC) guidance developed in 2013 for First Nations SWP planning. Development of SWP plans in Ontario First Nation communities has not been undertaken for a number of reasons. Many First Nations in Ontario exist outside of the provincial "source protection regions" where municipal SWP plans have been developed under the Ontario framework. Lack of capacity and funding for highly technical and expensive source water assessments also hamper working within the Ontario planning framework. This presentation will outline the process undertaken by OFNTSC, the IWS and the community of M'Chigeeng to develop a SWP plan for their community. The presentation will also address the outcomes of various planning processes in other Ontario First Nations using different approaches.

Detection of Pesticides in Four Manitoba Rivers

Mauli Isuruni Gamhewage (MSc student, University of Manitoba)
Anita Murdock (BSc student, University of Manitoba)
Prof. Annemieke Farenhorst (soil science, University of Manitoba)
Dr. Claudia Sheedy (Agriculture and Agri-Food Canada)
Denise Nilsson (Agriculture and Agri-Food Canada)

Pesticide transport from agricultural land to groundwater and surface water can lead to environmental contamination. This study was initiated because Fisher River Cree Nation was concerned about pesticide contaminants in the Fisher River that flows through areas with agricultural production and natural wetlands before entering Lake Winnipeg. The research was extended to examine the types and concentrations of pesticides in the water and bottom sediments of three other Manitoba rivers that flow into the lake. From May to August 2016, 83 water-column and 69 bottom sediment samples were collected and analyzed by GC-MS/MS for a suite of 161 pesticides. 78% of water-column and 99% of sediment samples contained at least one pesticide. In Fisher River, MCPA was the most detected pesticide in both water-column (53%) and bottom sediments (60%) with maximum concentrations of 70 ug/L and 28 ug/L, respectively. MCPA also had the highest detection frequencies in water-column (89%) and sediments (95%) of the Red River and in sediments (73%) of the Winnipeg River. Crop land in the Fisher Branch area seems to be contributing to pesticide loadings into Fisher River. Pesticide use in the city of Winnipeg appears to be substantially contributing to the contamination of the Red River, in some months more than agricultural use.

Methodology and Objectives of Collecting Sediment Samples along the Nelson River System

Masoud Goharrokhi (Ph.D. student, University of Manitoba)
Prof. David Lobb (soil science, University of Manitoba)
Prof. Phil Owens (environmental science, University of Northern British Columbia)

Electrical energy demand on Manitoba power plants has increased significantly over the decades. While hydropower plants provide renewable energy and operate without producing air pollution or toxic byproducts, they alter the flow regime of rivers and

consequently affect sediment generation and deposition processes. Excessive fine sediment loads are responsible for a number of environmental and operational problems such as reducing light penetration through the water column, altering or eliminating aquatic habitat, impairment of navigation, limiting reservoir capacity, declining quality of drinking water resources, and transport of nutrients and a variety of contaminants. This study explores the potential effects of hydroelectric dam operations (flow regulation) on water resources and sediment production along the Nelson River system by examining sedimentary processes from Lake Winnipeg to Hudson Bay. Documenting sediment characteristics below and above each dam provides a wealth of information on the nature, source, and magnitude of sediment transfers.

Old Technologies with New Applications: Impacts on Aquatic Organisms

Erin Hayward (MSc student, Trent University)

Many First Nation communities are looking for economical technologies to upgrade their wastewater treatment systems without having to expand the size of lagoons or install expensive aeration systems. In bench-scale studies in the laboratory, ozone pre-treatment has been shown to improve wastewater quality and removal of contaminants of emerging concern. Pilot projects are scheduled for 2017 and 2018 in two Ontario First Nation communities to evaluate the effectiveness of ozonation as a wastewater pre-treatment technology. The treated wastewater will be tested in the laboratory for its potential to impact aquatic organisms downstream of the effluent discharge, using acute toxicity testing with rainbow trout and adult fluted-shell mussels, as well as their larvae. The impacts of treated wastewater will also be tested in the field through caging adult fluted-shell mussels upstream and downstream of lagoons during the discharge period. We predict that ozone pre-treatment of lagoon wastewater prior to discharge will be effective at improving wastewater quality and will be an economically feasible option for upgrading lagoons, without investing in expansion of current facilities or installing aeration systems. The scope of this project, as well as preliminary data on the quality of wastewater in the lagoon of one of the First Nation communities, will be described in this presentation.

Detection of E. coli/Total coliforms and Antibiotic Resistance Genes in Drinking Water Collected from Three First Nation Communities in Manitoba

Ruidong Mi (MSc student, University of Manitoba)
Tina Kitchkeesick (Canupawakpa Health Services)
Prof. Annemieke Farenhorst (soil science, University of Manitoba)
Prof. Ayush Kumar (microbiology, University of Manitoba)
Prof. Francis Zvomuya (soil science, University of Manitoba
Prof. Ehsan Khafipour (animal science, University of Manitoba)

We analyzed source and drinking water (cistern, pipeline and well water) collected from three First Nation communities (F, P and C) for *E. coli*/coliform bacteria and antibiotic resistance genes. Results to date include the detection of coliform bacteria in cistern

water in communities P and C, and in well water in community C. Pipeline water in communities P and C and all samples in community F were negative for coliform bacteria. Not surprisingly, free residual chlorine levels were lower than the 0.2 mg/L level recommended by WHO in those samples that were positive for coliform bacteria. Host-specificity of *E. coli* is also being checked. Antibiotic resistance genes *tetA, ampC, vanA*, and *mecA* were tested in water samples. Only *ampC* was found in a few samples. *E. coli*. are also being tested for whether they carry lactamase and carbapenemase genes. The results suggest that First Nation residents of homes with cisterns are at greater risk for exposure to coliform bacteria relative to First Nation residents of homes connected to a water treatment plant by pipes, or of homes that rely on well water. Coliform bacteria are also more likely to be found in drinking water with low free residual chlorine levels.

Contaminants of Emerging Concern in Wastewater, Receiving Waters and Drinking Water

Craig Murray (Institute for Watershed Science, Trent University)
Prof. Chris Metcalfe (Institute for Watershed Science, Trent University)

We will present a brief introduction to contaminants of emerging concern (CEC) and methods of sampling and analysis to determine concentrations of these chemicals in water. The results of 5 separate studies coming out of the Institute for Watershed Science and the Chris Metcalfe Lab at Trent University will then be presented to give an overview of CEC in our environment. We will present our research on the effectiveness of wastewater treatment in removing CECs, and the concentrations of CECs in a river that receives wastewater effluent. We will also present our data that shows the concentrations of pharmaceuticals and personal-care products in 5 drinking water treatment plants in Ontario, as well as a study that focuses on concentrations of neonicotinoid insecticides in 6 drinking water treatment plants in Southern Ontario. Finally, we examine the results of a study that determined concentrations of drugs of abuse in the Grand River.

Determination of the Effect of Activated Carbon in Water Treatment Processes

Prof. Selvin Peter (University College of the North)
Danielle Garrioch (undergraduate student, UCN)
Rakesh Patel (science technician, UCN)

This project looks at the role of activated carbon in water treatment, particularly in capturing organic particles such as diesel, crude oil and gasoline that are semi-miscible or immiscible in water. A laboratory study is being conducted for treatment of water with known composition of diesel through an activated carbon filter bed. The filtrate (treated water) is analyzed for diesel particles. Preliminary results show this method is promising. This procedure will be repeated with activated carbon of various particle sizes and other physical properties, including the activated carbon used in some water treatment plants. A survey of water treatment plants in northern Manitoba First Nations

will be done to determine if activated carbon is used as part of the processes and at what stage. The water treatment plant in Pimicikamak First Nation, which uses activated carbon, will be used as a reference for comparison of treated water quality. Some of the water treatment plants being considered for comparison are Mosakahiken, Mathias Colomb and Pine Creek. A pilot study will be undertaken to optimize the processes that include activated carbon. Theoretical studies will also be done to determine the effect of activated carbon particle size and porosity, and the porosity of the activated carbon filter bed.

Characterizing and Identifying Sediment Sources in Norway House Cree Nation Drinking Water Using a Sediment Fingerprinting Technique

Johanna Theroux (MSc, University of Manitoba)
Prof. David Lobb (soil science, University of Manitoba)
Prof. Annemieke Farenhorst (soil science, University of Manitoba)

Suspended sediments eroded from 2-Mile Channel were identified as a potentially significant contaminant affecting drinking source water quality in NHCN in north-central Manitoba. This study used sediment fingerprinting to determine the relative contributions of sediment sources throughout the catchment to suspended sediments in the Jack River drinking water intake. Source soils and suspended sediments were sampled from June-October 2014 and in spring 2015. Samples were analyzed for colour using diffuse reflectance spectrometry and were further analyzed for Cs-137 using gamma-ray spectroscopy to identify individual properties that could discriminate between source areas. These properties were selected using Shapiro-Wilk test, biplot analysis and Kruskal-Wallis H-test. A quadratic discriminant function analysis was used to determine the optimal combination of properties to include in the sediment fingerprint. 3 color coefficients were included in the MixSIAR unmixing model to determine the relative contribution of each source to suspended sediment at the drinking water intake. 79.3% (SD=31.2%) of the sediments originated from the natural outlet of Lake Winnipeg, 9.3% (SD=18.8%) originated from the clay soils of channel banks, and the remaining 8.0 % (SD=18.2%) and 3.3% (SD=6.4%) originated from 2-Mile Channel suspended sediments and organic deposits. The 2-Mile Channel did not significantly contribute to suspended sediments in the drinking water intake during the sampling period.

Microplastic contamination in Lake Winnipeg, Canada

Sarah Warrack (MSc student, University of Manitoba)
Philip Anderson (MSc student, University of Saskatchewan) first author
Victoria Langen (MSc student, Lakehead University)
Jonathan Challis (PhD student, University of Manitoba)
Prof. Mark Hanson (environment, University of Manitoba)
Prof. Michael Rennie (biology, Lakehead University)

Microplastics are an emerging contaminant of concern in aquatic ecosystems. To better understand microplastic contamination in North American surface waters, we report for

the first time densities of microplastics in Lake Winnipeg, the 11th largest freshwater body in the world. Samples taken 2014 to 2016 revealed similar or significantly greater microplastic densities in Lake Winnipeg compared with those reported in the Laurentian Great Lakes. Plastics in the lake were largely of secondary origin, overwhelmingly identified as fibres. We detected significantly greater densities of microplastics in the north basin compared to the south basin of the lake in 2014, but not in 2015 or 2016. Mean lake-wide densities across all years were comparable and not statistically different. Scanning electron microscopy with energy dispersive X-ray spectroscopy indicated that 23% of isolated particles on average were not plastic. While the ecological impact of microplastics on aquatic ecosystems is still largely unknown, our study contributes to the growing evidence that microplastic contamination is widespread even around sparsely-populated freshwater ecosystems, and provides a baseline for future study and risk assessments.

POSTERS

Hydroelectrical Generation Project for Northern Manitoba

Victoria Grima (Master of Environment student, University of Manitoba)

The 1913 geological and environmental characteristic study that William McInnes carried out on the drainage basins of the Nelson and Churchill rivers is considered to be one of the most significant studies that encouraged the province to explore its northern waters as a possible source of hydroelectric power. Thus, Manitoba's crown corporation, Manitoba Hydro, began development in the early 1960s of its northern hydroelectrical generation project. The project aims to fully harness the hydrological power of the Kache Sipi, the Nelson River, supplementing it with a diversion of the Churchill River. This project is being accomplished through construction of hydroelectric generating stations and water level/flow regulatory infrastructure. To facilitate transferral of the electrical power produced towards the southern end of the province, converter stations were constructed and high-voltage direct current transmission lines were installed.

Using Satellite Images to Conduct Near Real-Time Assessment of Algal Blooms on Prairie Lakes

Claire Herbert (MSc student, University of Manitoba)

Canadians spend millions of dollars each year protecting waterways from urban and agricultural pollutants and keeping fisheries healthy. However, limited government funding precludes extensive sampling of many lakes. Since the 1970s, only two whole-lake water quality studies have been conducted on Lake Manitoba, the 11th largest freshwater lake in North America. Lake Winnipegosis, the 21st largest freshwater lake in the world, and Waterhen Lake, with the first freshwater fishery in North America to be certified sustainable, have never had whole-lake surveys. Remotely sensed imagery is a cost-effective way to monitor water quality on a broad scale. By combining satellite imagery with surface water sampling and analysis, scientists can learn more about how nutrients may be contributing to algal blooms. Surface water samples from lakes

Winnipegosis, Manitoba and Waterhen will be analyzed for a variety of chemical parameters, including phosphorous, TSS and chlorophyll. Algae will be identified and any potential toxin producers will be tested. The data will be used to develop and calibrate a method to use satellite imagery as a way to calculate chlorophyll concentrations and therefore algal bloom concentrations in these lakes.

Assessing Actual and Perceived Risks of Drinking Water Contamination – A Multiple Case Study

Marsha Serville (PhD student, Trent University)
Prof. Chris Metcalfe (Institute for Watershed Science, Trent University)

Exposure to microbial and chemical contaminants in surface and drinking water creates health risks for people living in potentially at-risk communities. This study applies a convergent parallel mixed-methods design to assess the role of actual and perceived risks for water managers in the development of water management strategies for potentially at-risk Indigenous and rural communities in Canada and the Caribbean. Quantitative data, which illustrate actual risks from contamination of drinking water sources by fecal bacteria, current use pesticides (CUPs) and chemical indicators of wastewater, will be collected using a combination of traditional grab sampling and a polar organic chemical integrative sampler. POCIS has the ability to reflect seasonal and temporal changes and detect trace concentrations of contaminants (ng/L). Concurrently but independently, qualitative data on risk perceptions of water managers and health professionals will be collected through focus group interviews. The data will be analyzed independently, then integrated for an in-depth interpretation of how actual and perceived risks are applied in the development of feasible water management strategies.

INDIGENOUS LANGUAGE GLOSSARY

Inninuwéwin (Cree language)

Tansi (hello)
Nipi (water)
Ekosi (general greeting for good-bye, thank you, that is all. Often used when ending a conversation)
Kinanâskomitin (thank you)
Inninuw (person of the land)
Inninuwak (people of the land)

Anishinaabemowin (Ojibway language)

Aaniin or Boozhoo (hello)
Nibi (water)
Meegwetch (thank you)

Dene Yaté (Dene language)

Edlánét'e (hello)
Tu (water)
Masi (thank you)

Dakota iapi (Dakota language)

Haå (hello or yes – female speech)
Hau (hello or yes – men's speech)
Mni (water)
Pidamiya ye (Dakota woman's version of thank you)
Pidamiya do (Dakota man's version of thank you)

The words above may be spelled differently from one community to the next. Dialects or ways of saying an Indigenous word will also vary.

NOTES

We would like to thank our program sponsors, including:

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