2019

THE WATER INSTITUTE

Interdisciplinary
Innovative
International

UNIVERSITY OF WATERLOO

the water INSTITUTE

MEMBERSHIP

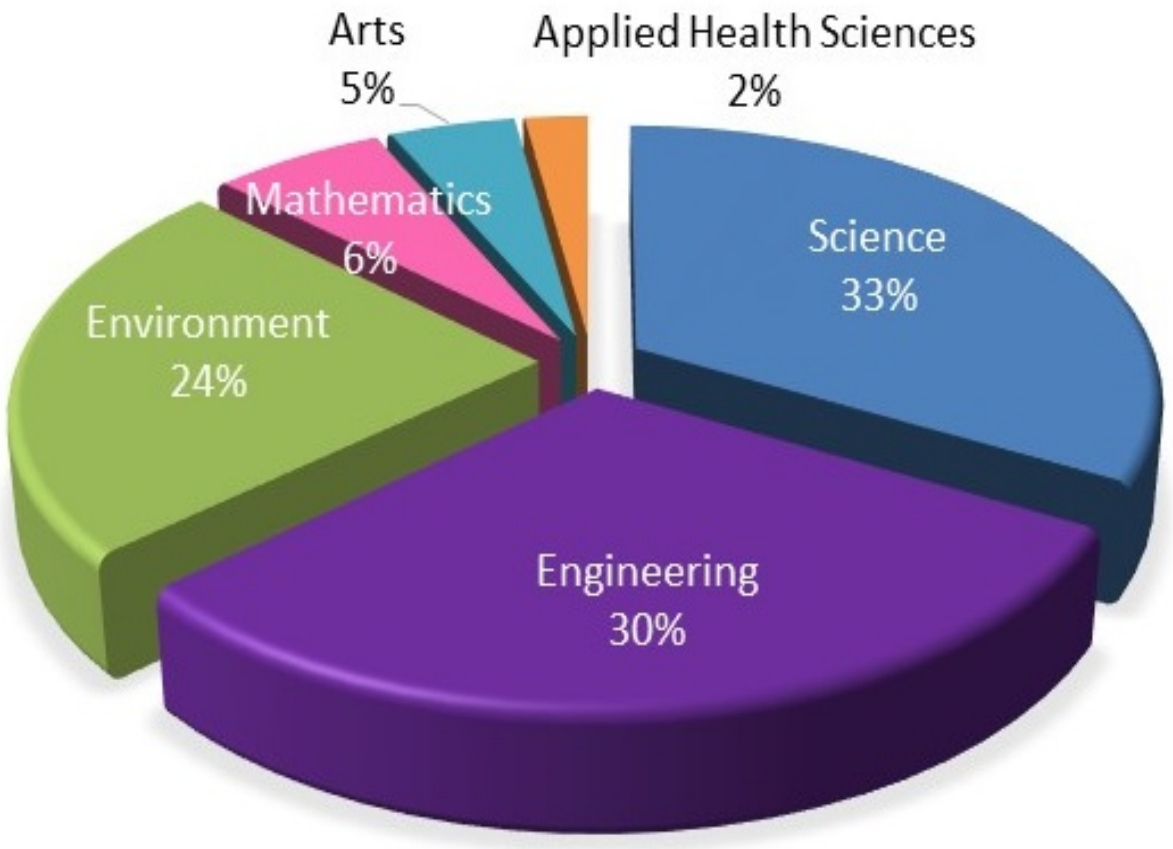
150+ faculty members

300+ graduate students

25 Research Chairs

From all 6 faculties

Arts, Applied Health Sciences, Engineering, Environment, Mathematics, and Science.



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PURPOSE

1. Promote, support and demonstrate interdisciplinary water research.
2. Promote and support interdisciplinary perspectives in water-related education.
3. Strengthen global networks and partnerships with leading water organizations and researchers.
4. Promote knowledge transfer and exchange to communicate the impact of the Waterloo's research.

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INTERDISCIPLINARY RESEARCH THEMES

APPLIED HEALTH SCIENCES
- Public Health and Health Systems
- Recreation and Leisure Studies

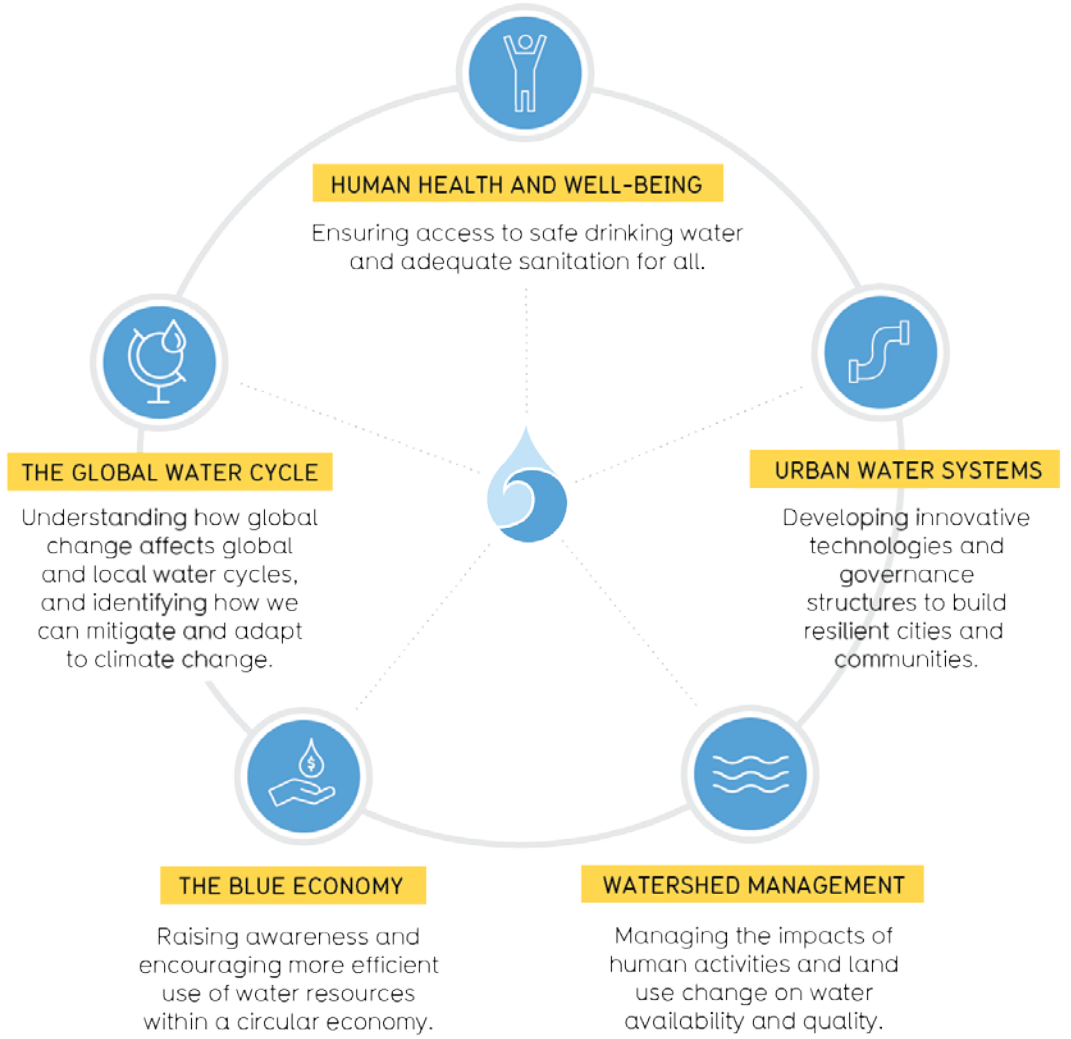
ARTS
- Accounting and Finance
- Economics
- Philosophy
- Political Science
- Social Development Studies

ENVIRONMENT
- Environment, Enterprise and Development
- Environment, Resources and Sustainability
- Geography and Environmental Management Planning

ENGINEERING
- Architecture
- Chemical Engineering
- Civil and Environmental Engineering
- Electrical and Computer Engineering
- Mechanical and Mechatronics Engineering
- Systems Design Engineering

MATHEMATICS
- Applied Mathematics
- Computer Science

SCIENCE
- Biology
- Chemistry
- Earth and Environmental Sciences



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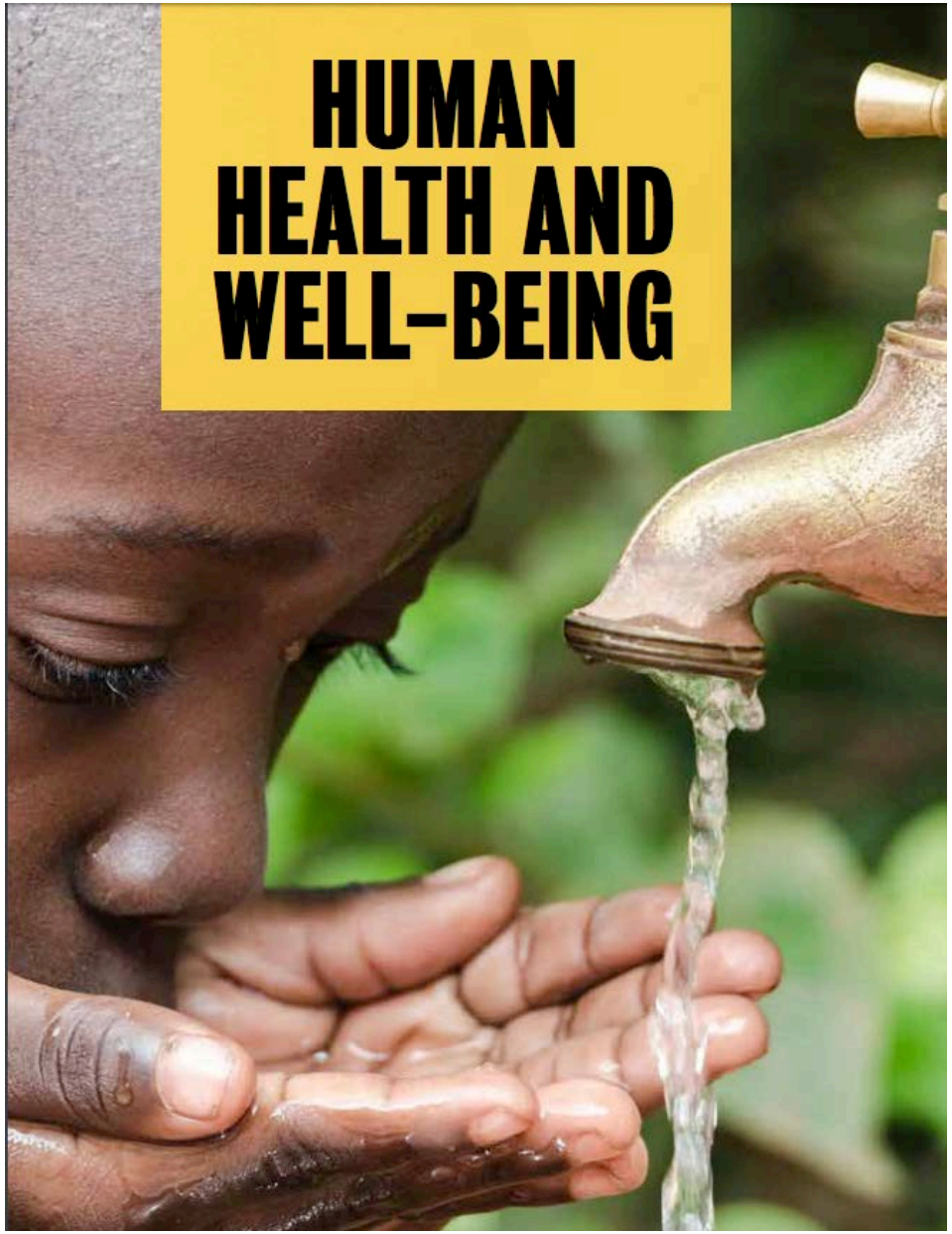

Current Water Institute research within Human Health and Well-being includes:

- Understanding relationships between the environment, water, and human health;
- Effective water and sanitation schemes for maternal and child health;
- Understanding the burden of, and risks for, waterborne infectious diseases in human populations;
- Assessing the impact of the extractive industry on public health;
- Developing integrated health impact assessment concepts and methods;
- Understanding the impact of natural disasters on community and human health;
- Developing nano-sensors and lab-on-chip devices to test water quality.

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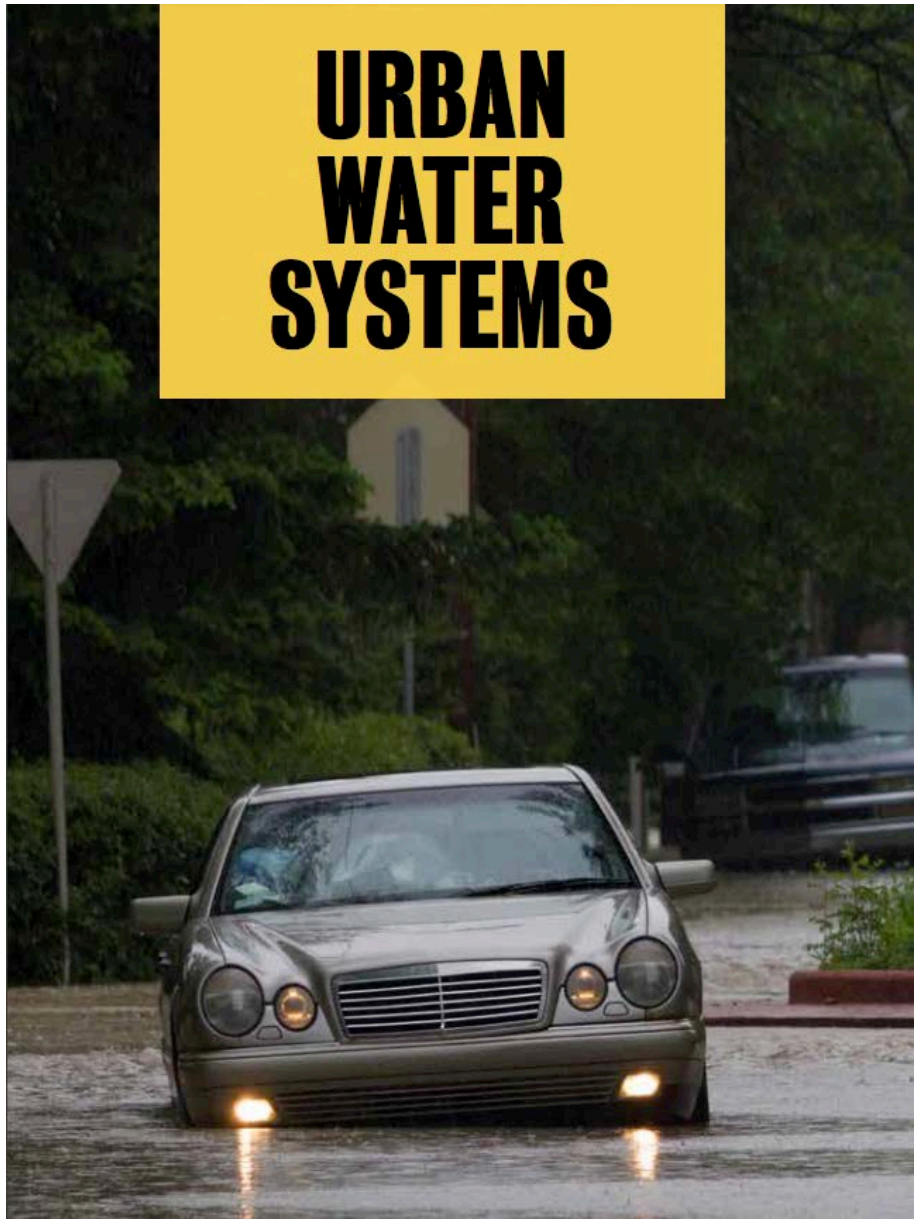

Current Water Institute research within Urban Water Systems includes:

- Investigating innovative and emerging drinking and wastewater treatment processes and technologies;
- Investigating the production of bio-energy and bio-chemicals from biomass, and nutrient recovery from organic waste and wastewater;
- Assessing the fate and removal of emerging contaminants in wastewater systems;
- Investigating the use of nano-materials in wastewater treatment and nano-devices for detection;
- Assessing the impacts of climate change on water treatment systems;
- Developing water and wastewater infrastructure asset management tools;
- Evaluating the environmental exposure and effects of emerging contaminants in aquatic systems;
- Conducting field and numerical modelling studies on urban river mechanics, hydraulics, and hydrology;
- Undertaking river restoration/rehabilitation and aquatic habitat improvements;
- Developing risk assessment and management approaches for priority substances;
- Developing integrated management approaches, including land-water management, demand-focused water strategies, and the use of market-based policy instruments.

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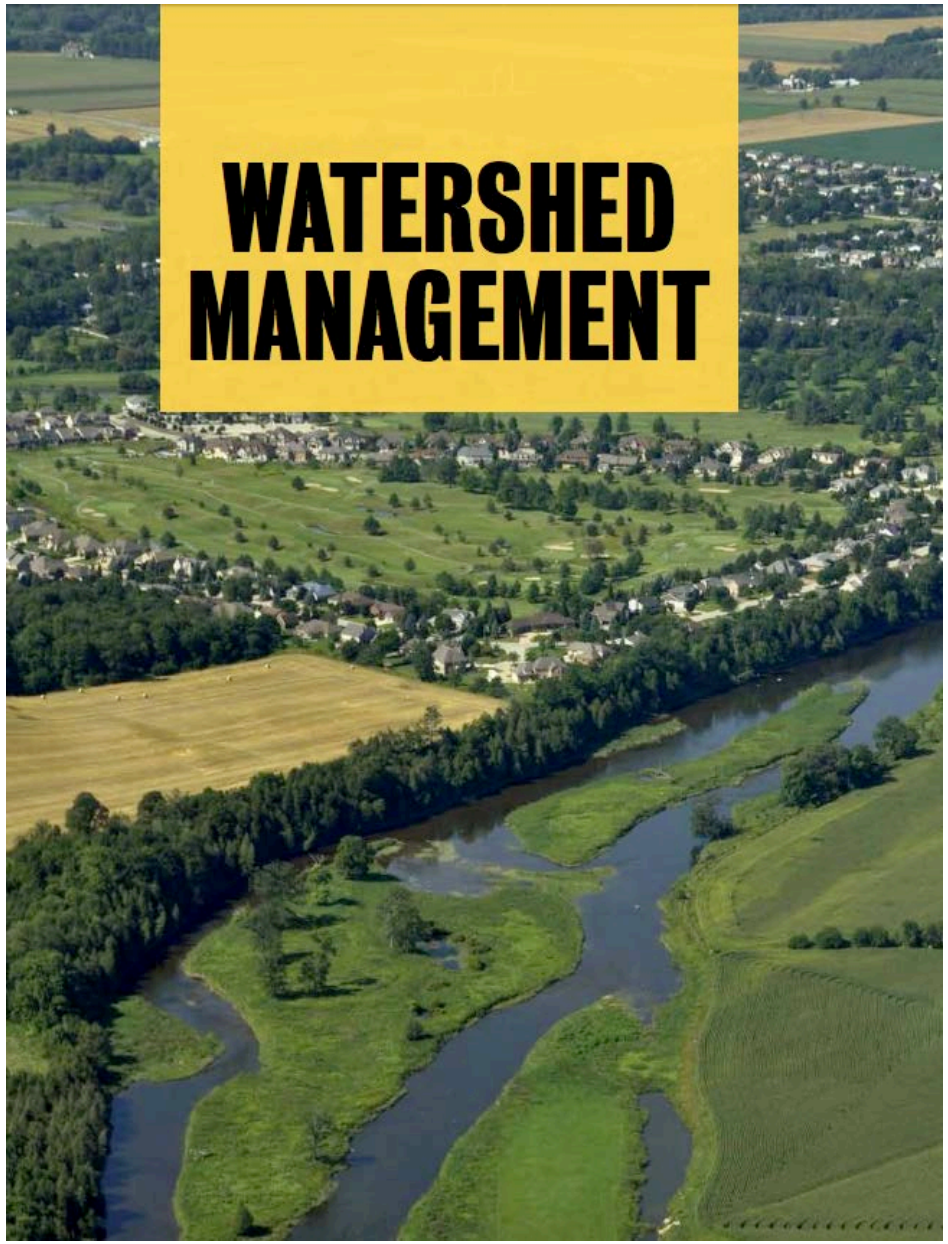

Current Water Institute research within Watershed Management includes:

- Characterizing interconnected surface and groundwater systems;
- Developing coupled surface and subsurface hydrologic models at mixed spatial and temporal scales;
- Assessing the effects of human activity and multiple stressors (eutrophication, acidification, climate change, river regulation, urbanization, species invasions) on watershed hydrology, water quality, biogeochemical processes, and aquatic systems;
- Advancing the understanding of the fluxes and transformations of nutrients (phosphorus, nitrogen, silicon) and metals at the groundwater-surface water interface;
- Defining wetland and lake ecological functions and stressors;
- Developing “smart” watershed data integration platforms to monitor conditions in real-time;
- Developing improved techniques for the prediction, remediation and prevention of groundwater contamination;
- Designing cost-effective ecological restoration and conservation activities;
- Identifying and assessing, including economically, water policy and governance arrangements, including integrated land-water management, drinking water source protection planning, and forest management-based approaches for water treatment resiliency.

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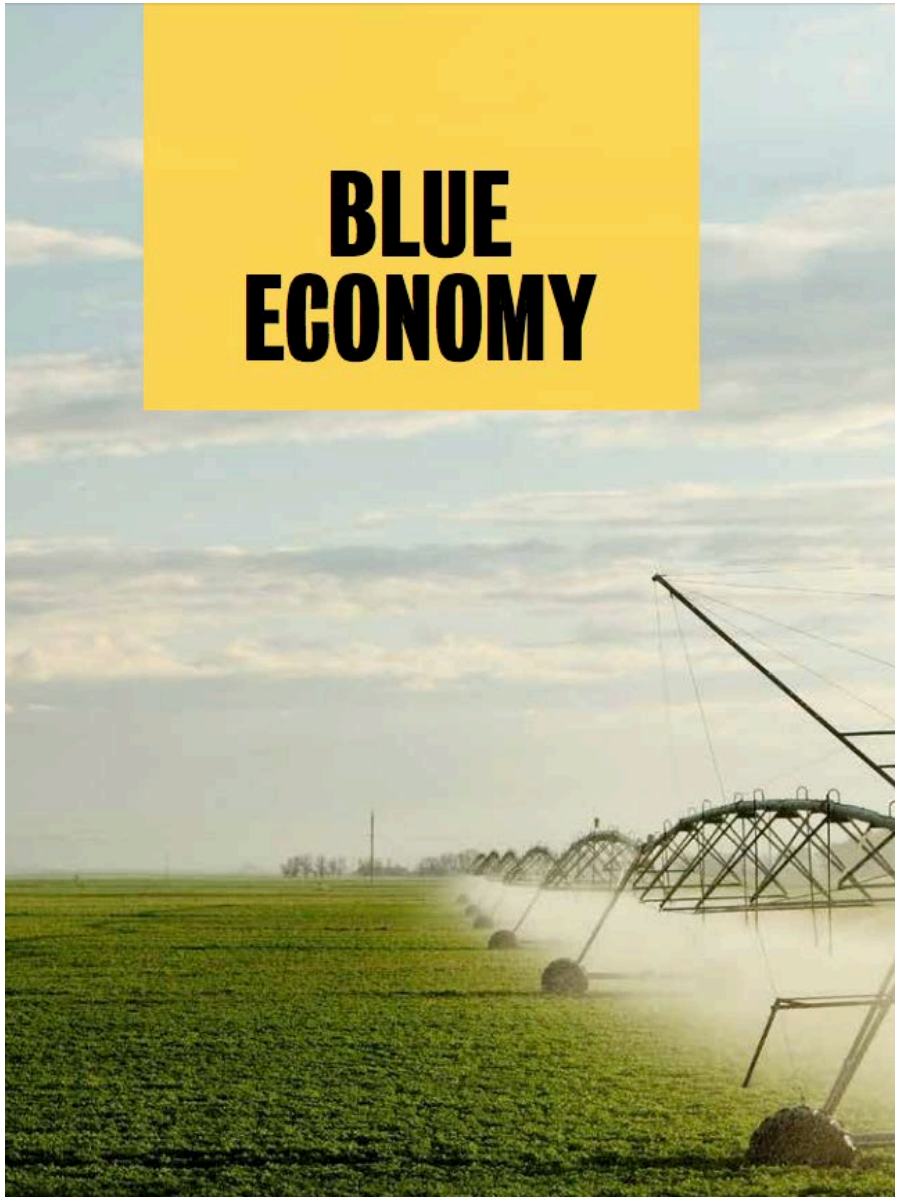
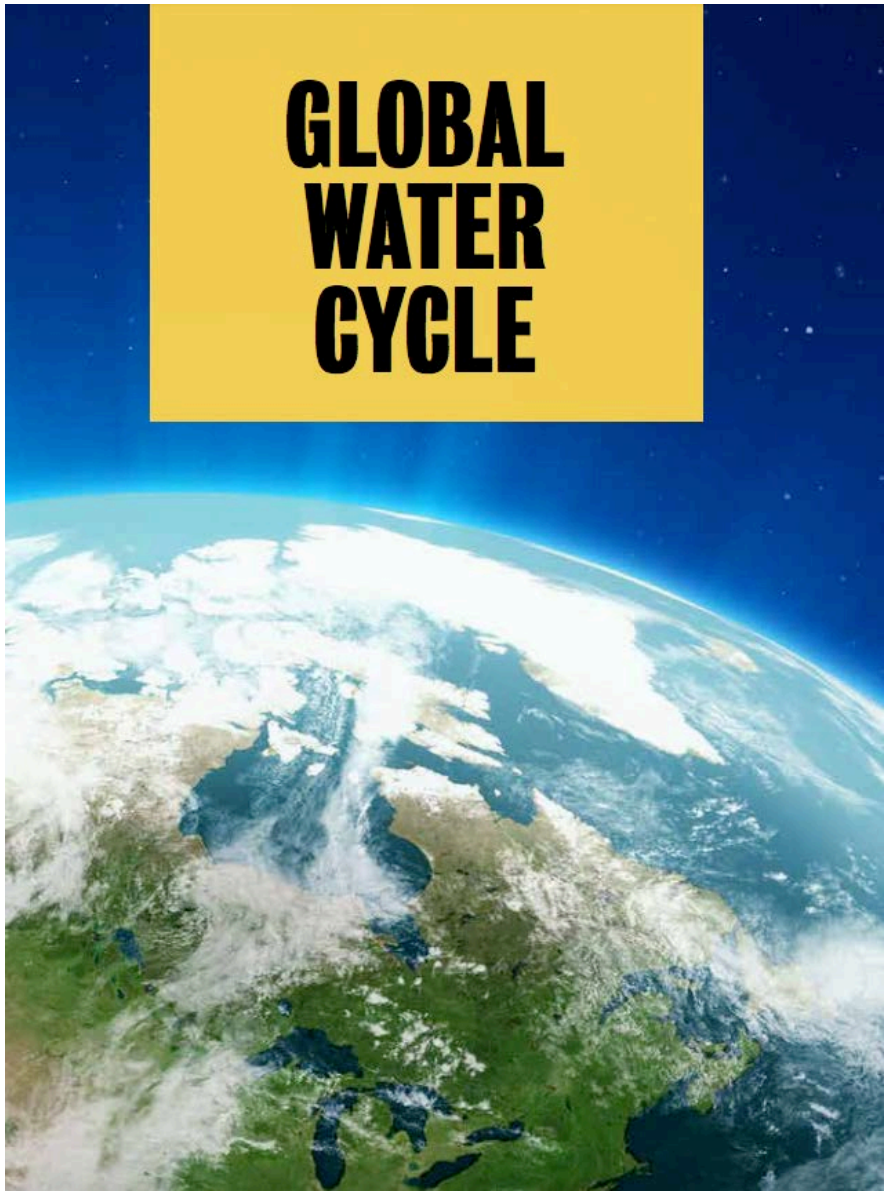


Current Water Institute research within Blue Economy includes:

- Determining the value of water and aquatic ecosystem services;
- Defining market-based instruments for water management, including water pricing;
- Linking and integrating water accounts and economic accounting systems;
- Developing integrated hydro-economic models to support water decision-making and policy at the watershed scale;
- Studying the treatment of water risks and opportunities in corporate water management;
- Calculating the water footprint of organizations and products;
- Developing smarter and more efficient water technologies and systems;
- Defining innovative, transboundary water governance models.



Current Water Institute research within this theme includes:

- Optimizing the calibration of atmospheric and hydrologic models;
- Estimating hydrologic extremes, and quantifying uncertainty, under various climate change scenarios;
- Investigating linkages between hydroclimatology, biogeochemical cycling, and surface-water chemistry;
- Understanding physical processes in oceans, lakes, and wetlands and their effects on biogeochemical processes;
- Observing snow and ice hydrology through remote sensing, modelling, and in situ measurement;
- Understanding the effects of climate change on aquatic food webs;
- Examining the hydrodynamics of lakes and wetlands;
- Assessing water-related impacts and vulnerabilities from climate change;
- Identifying cost-effective mitigation and adaptive management strategies at multiple governance levels.

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GLOBAL WATER FUTURES AT WATERLOO

Inception **2016**

90 Waterloo researchers and graduate students

Waterloo projects

9 Led by Waterloo faculty

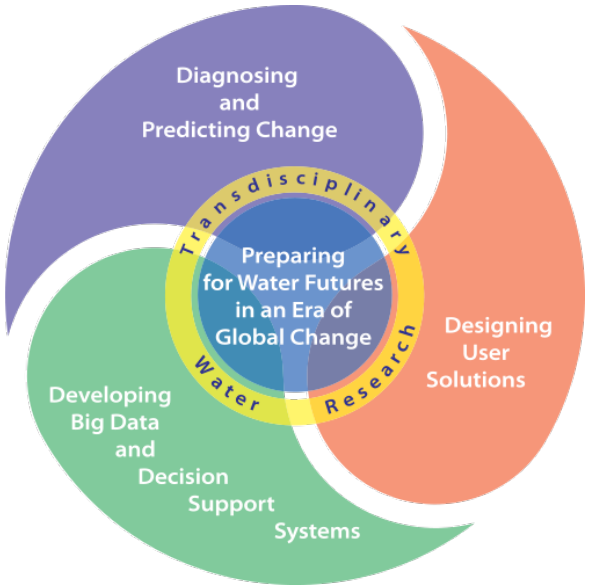
3 User Question-Led Projects

6 Transformative Science Projects

All 6 faculties

Arts; Applied Health Sciences; Engineering; Environment; Mathematics; Science

Funding



$15M

Canada First Research Excellence Fund

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USER QUESTION-LED PROJECTS

NANDITA BASU
Lake Futures
@Lake_Futures

CLAUDE DUGUAY
Transformative Technologies
@TTSW_GWF

MERRIN MACRAE
Agricultural Water Futures
@AWF_Research

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INNOVATION AND STARTUPS

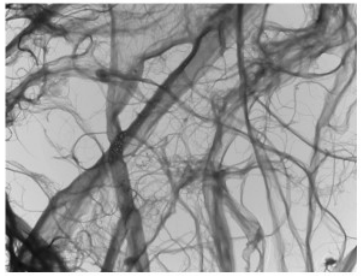
MILLIONS OF LAKES RIGHT IN OUR BACKYARD SERVE AS WINDOWS INTO EARTH'S ORGINS

Discovered that millions of lakes in Canada's Boreal Shield share physico-chemical similarities with the Archean oceans, and can be used as living laboratories for studying ancient oceans, greenhouse gas emissions, and harmful algal blooms.

IMPROVING HEALTH RESPONSES IN ZAMBIA

Using satellite imagery and geographic information systems to predict floods and malaria "hot spots" in near real-time.

NANOMATERIALS FOR WATER TREATMENT



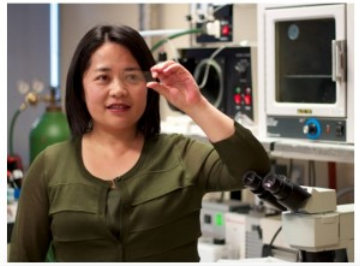
Using cellulose nanomaterials – those derived from wood, plants, algae and bacteria – to make water treatment processes more sustainable.

Michael Tam – Chemical Engineering

WORKING WITH INUIT TO UNDERSTAND AND REVIVE DWINDLING FISHERIES

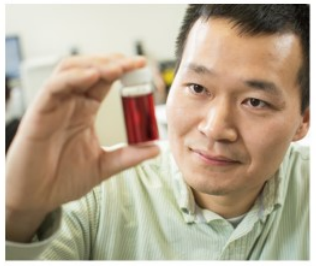
Working side-by-side with local fisheries and the Government of Nunavut to implement a restoration plan and train locals in science monitoring techniques that, when combined with their traditional knowledge, can be used to ensure fish remain plentiful into the future.

A LABRORATORY IN THE PALM OF YOUR HAND



QuantWave provides the first real-time and portable tool to monitor the pathogens in food and water without complicated sample preparations and pathogen labeling. This device can be integrated into existing facilities, minimizing the potential risk of pathogenic contamination and maximize the water safety.

USING DNA TO DETECT CONTAMINANTS



Developed a number of highly sensitive and selective fluorescent sensors with catalytic DNA for heavy metal detection, including lead, copper, mercury, and cadmium.

Juewen Liu – Chemistry

EMAGIN

Blue Lion Labs

biotech

PolyGone Technologies

CATALIGHT

Flushing towards a better FUTURE

watepuris

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SEED GRANTS PROGRAM

- Earmarked funding ($150,000/year) to catalyze new interdisciplinary collaboration, proposals and funding.
- Since 2011, a total of $731,000 has been invested in 43 seed grants projects.
- A review of 31 projects funded from 2011 to 2017, shows that the program has resulted in over $5 million in new, “downstream” research funding - implying a Return on Investment of 9.6 over 7 years.

ELSEVIER

Journal of Great Lakes Research

Volume 41, Issue 1, March 2015, Pages 9-19

Review

Plastic debris in the Laurentian Great Lakes: A review

Alexander G.J. Driedger, Hans H. Dürr, Kristen Mitchell, Philippe Van Cappellen

Show more

https://doi.org/10.1016/j.jglr.2014.12.020

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Scholarly output

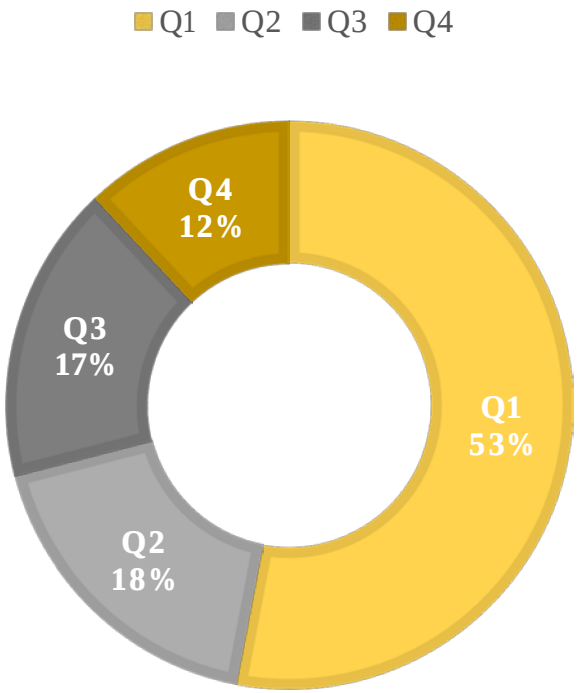
1500+ papers published since 2009

19,000+ papers cited since 2009

$165M+ Research funding since 2009

53%

of papers by Water Institute researchers in the top (Q1) quartile.



Web of Science. Water resources journals for 2010-17. Based 5-year impact factors.

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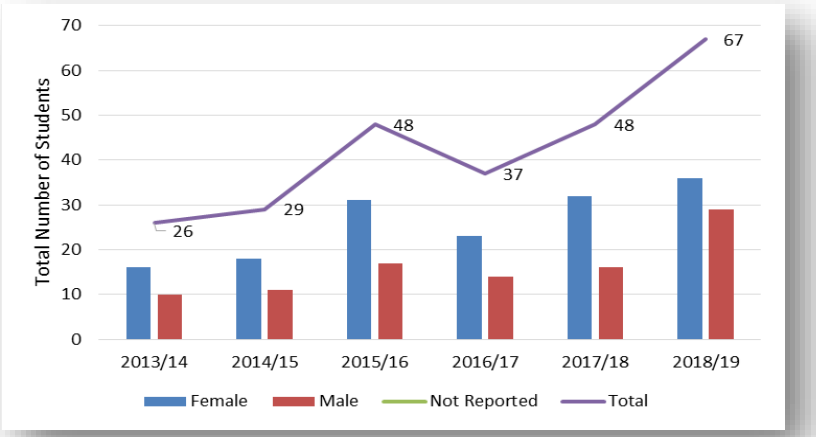
COLLABORATIVE WATER PROGRAM

Waterloo's most **INTERDISCIPLINARY** academic program

Provides supplemental *interdisciplinary* training to students in 11 "home" academic programs, Water Institute provides centralized program support.

PARTICIPATING DEPARTMENTS / SCHOOLS

1. Applied Mathematics
2. Architecture
3. Biology
4. Chemical Engineering
5. Civil and Environmental Engineering
6. Earth and Environmental Sciences
7. Economics
8. Environment, Enterprise and Development
9. Environment, Resources and Sustainability
10. Geography and Environmental Management
11. Public Health and Health Systems



Collaborative Water Program Enrollment
2013-14 to 2018-19

Supported by a $1.75M, 8-year gift from the RBC Foundation.

RBC Foundation

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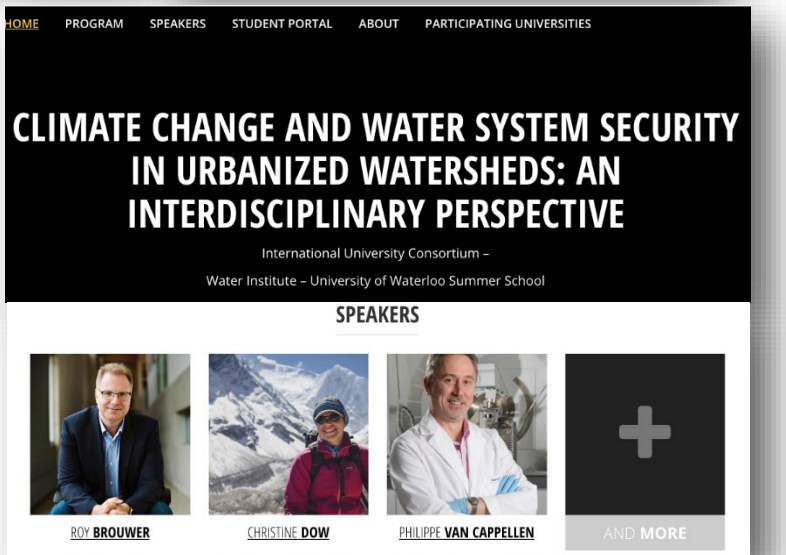
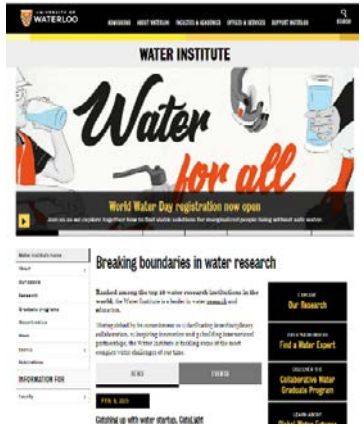
OTHER PROGRAMMING

- Water Institute Graduate Students Association (SWIGS).
- *AquaHacking* student innovation competition.
- *WaterTalks* lecture series.
- World Water Day celebration.
- Interdisciplinary conferences/symposia.
- RBC Distinguished Lecture series.
- RBC Visiting fellows program.
- *WaterConnections* industry liaison events.
- Interdisciplinary PhD Summer School.



INTERNATIONAL PARTNERSHIPS

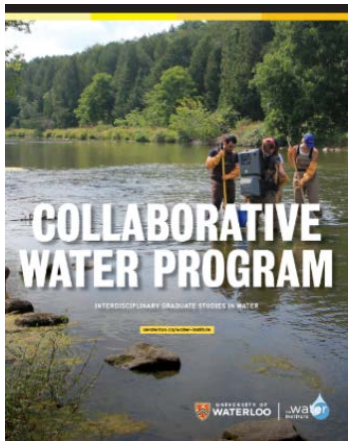
COMMUNICATIONS



Website

Impact Report

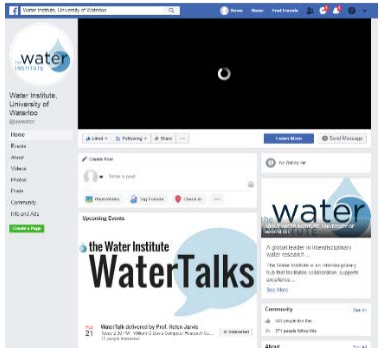
WaterResearch



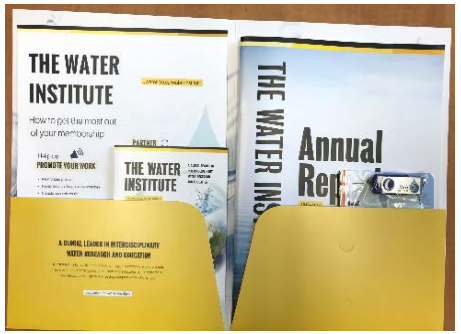
Brochures

WaterNews

Twitter

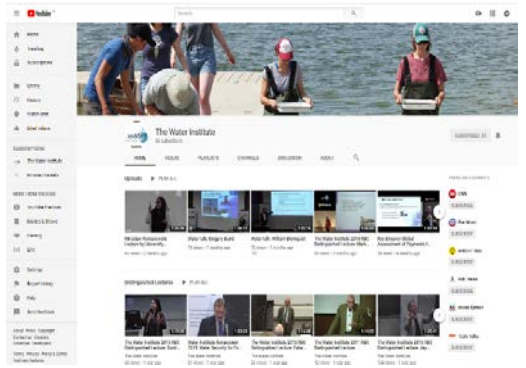


Facebook



Member packages

Video



YouTube

Media

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26th in the world
for water research

ShanghaiRanking's Global Ranking of Academic Subjects – Water Resources, 2017

10th best water research institution in the world

Lux Research Inc. Top Academics and Institutions in Water Research, 2013

20th most prolific
water research institution in the world

Stockholm International Water Institute and Elsevier the Water and Food Nexus: Trends and Development of the Research Landscape, 2012

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