# RYERSON URBAN WATER

## Strategic Plan 2017-2022

**Research, Education, Policy: Healthy Water. Healthy Cities.**

Ryerson University | Ryerson Urban Water

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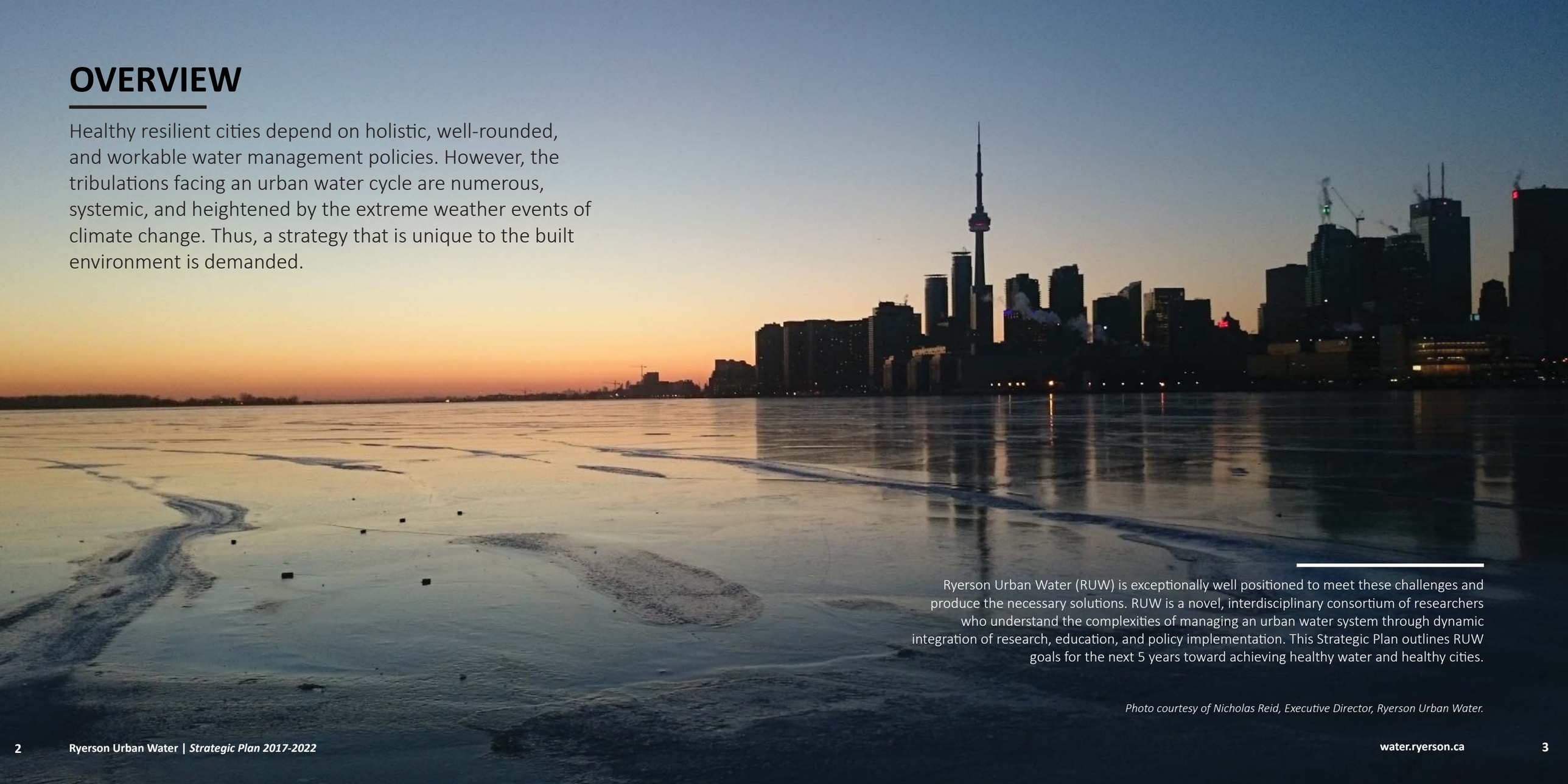
# OVERVIEW

Healthy resilient cities depend on holistic, well-rounded, and workable water management policies. However, the tribulations facing an urban water cycle are numerous, systemic, and heightened by the extreme weather events of climate change. Thus, a strategy that is unique to the built environment is demanded.



Ryerson Urban Water (RUW) is exceptionally well positioned to meet these challenges and produce the necessary solutions. RUW is a novel, interdisciplinary consortium of researchers who understand the complexities of managing an urban water system through dynamic integration of research, education, and policy implementation. This Strategic Plan outlines RUW goals for the next 5 years toward achieving healthy water and healthy cities.

*Photo courtesy of Nicholas Reid, Executive Director, Ryerson Urban Water.*

# CONTEXT

The past half century has witnessed exhaustive discussion on the water-food-energy nexus including the Club of Rome's 1972 *The Limits to Growth*, the 1987 Brundtland Report *Our Common Future*, and the 1992 Rio Earth Summit. Unfortunately, few comprehensive solutions have been implemented and intensified urbanization, exacerbated by climate change, is leading to unbalanced urban water cycling.

In water-rich urban settings such as those surrounding the Laurentian Great Lakes, a sustainable water cycle is not perceived as a major priority; in fact, most citizens believe their urban water cycle to be healthy and resilient. This is a costly myth as contaminants from the impermeable built environment continually bombard source waters with stressors such as organic and heavy metal pollutants, excess nutrients, thermal pollution, erosion, and pathogens from combined sewer overflows. Additionally, source waters such as Lake Ontario, that once had wetlands as natural filtration systems, are not able to withstand such an onslaught. Thus, water for human consumption and industry must be cleaned and transported at an exorbitant cost to society in terms of treatment and energy. Moreover, additional challenges such as unprecedented flooding of roadways, degradation of urban water and air quality, power interruptions, loss of farm land, and a host of other problems affect the liveability and health of our cities.

*Ryerson Urban Water is addressing these challenges and working alongside stakeholders from government, industry, and community associations to implement pragmatic, paradigm-shifting solutions to ensure a healthy urban water cycle.*

RUW is a multi-disciplinary collective of research experts whose objective is to provide practical solutions to urban water challenges. Additionally, promoting innovation in water education across societal boundaries and advocating transformative policy framework implementation is a further goal. RUW is advancing the adoption of strategies that build healthy resilient cities through a holistic approach that connects new technologies and philosophies to the broad eco-fiscal benefits of conservation and sustainable development.

# MISSION AND VISION

RUW's mission is "**Providing Solutions to Urban Water Challenges through Research, Education, and Policy.**"

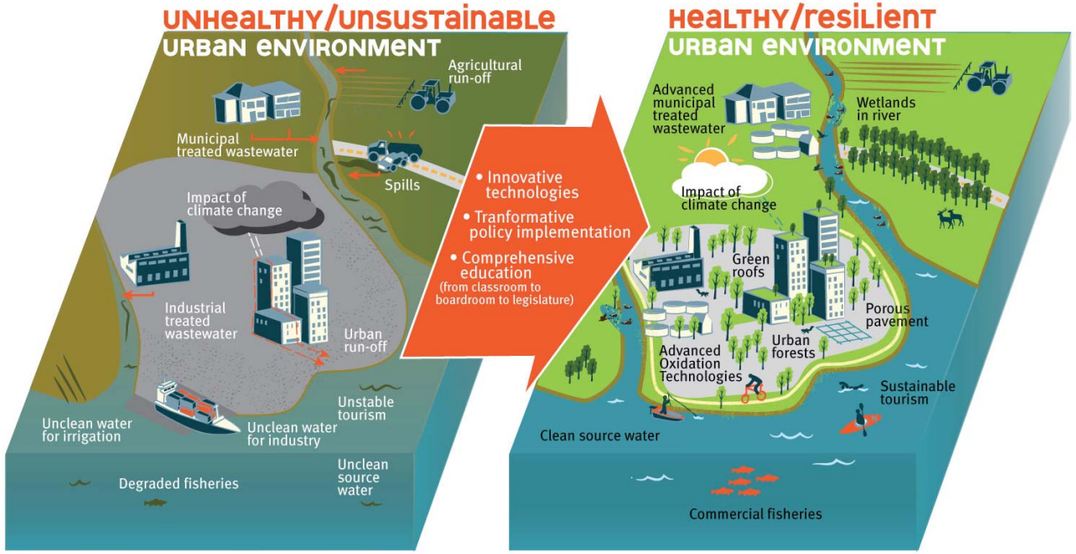
We provide a holistic approach to advancing solutions for urban water through:

1. Implementing an integrated strategy in applied research with a broad range of expertise from the natural and social sciences, engineering, economics, and policy.
2. Delivering educational programs to broaden understanding of urban water issues through community outreach and K-12 education programs, professional courses and training, and undergraduate and graduate programs.
3. Providing a platform for engagement, discussion, and knowledge mobilization of urban water challenges for all levels of government, industry, community groups, and other various stakeholders.

By 2022, our vision is that RUW will be Canada's preeminent institution on urban water issues and an international leader in sustainable and holistic urban water management through applied research, education, community outreach, and policy development.



# TRANSFORMING URBAN SPACES




**Research, Education, Policy: Healthy Water. Healthy Cities.**


# Current Status

*Ryerson Urban Water (RUW) is located in the heart of Canada's largest metropolis and the world's largest freshwater capital, with 46 kilometers of waterfront, six watersheds, and more than a dozen rivers.*

RUW is the only water centre that engages with the community, city planners, and water sector experts, through dynamic integration of applied research, education, community outreach, and policy development. A uniquely urban and innovative university, Ryerson is known for its entrepreneurial approach, zone learning, practical and community-based solutions, and city-building strategies.

***Photo courtesy of Nicholas Reid, Executive Director, Ryerson Urban Water.*** *The Student Learning Centre has transformed the corner of Yonge and Gould Streets into one of Toronto's most vibrant, people-friendly intersections. The building demonstrates leadership in energy and environmental design through LEED green building certification and features a green roof and rainwater-harvest system in which rainwater is used for sanitary fixtures, thereby reducing the load of rainwater entering storm sewers and reducing demand for the city's treated water.*

Over the last half century, governments, academic institutions, and industry have attempted to find answers to the environmental challenges besetting freshwater systems. However, in recent years, there have been systemic reductions in funding for water research and in parallel, Canada's only Great Lakes water centre (the Canada Centre for Inland Waters) has been diminished. In response, a comprehensive cohort of water research experts at Ryerson were inspired to create Ryerson Urban Water.

RUW comprises more than 40 researchers from 6 Faculties across 13 Departments and collectively embodies a depth and breadth of applied research capabilities to address urban water challenges in a holistic fashion. Our experts are conducting research to transform urban landscapes using naturally-styled, water capture and amelioration strategies (i.e., green roofs, urban forests, engineered wetlands), low impact development technologies (i.e., permeable hardscape, bio-retention and exfiltration pipes), sophisticated wastewater mitigation programs (i.e., advanced oxidation processes), municipal master planning, and cost-benefit, transformative economic policy implementation. RUW has the expertise necessary to ensure the development of resilient sustainable cities (Table 1, page 31).

# ACHIEVING OUR GOALS

Ryerson Urban Water is delivering its vision by setting goals and actions to achieve measurable results through the pillars of Research, Education, and Policy.

RUW Experts (Table 1, page 31) have the broad expertise to deliver critical research objectives identified by the sector, education programs to students, public, and professionals, and policy strategies to promote sustainable urban water management. Our Think Tank will engage stakeholders and provide the forum for knowledge-sharing through round tables, dialogue, and dissemination of solutions. As well, Ryerson's unique zone learning culture supports the incubation of innovative concepts to enable entrepreneurial pursuits and the commercialization of transformative solutions for healthy cities.

Thematic pursuits include:

**RESEARCH**

- Green infrastructure policy, resilient cities, sustainable development
- Blue and green master planning and low impact development
- Water and wastewater optimization, data analytics, and modeling
- Urbanizing watersheds, land use, and remediation

**EDUCATION**

- Multi-disciplinary and international student collaborations to solve real world problems
- Championing water education at elementary and secondary school levels
- "Teach the Teacher" and other professional programs
- First Nations as mentors in traditional ecosystem knowledge

**POLICY**

- Green roofs, urban farming, and urban forestry best practices
- Green policy instruments and resilient cities
- Great Lakes and inter-jurisdictional barriers
- Social, economic, and policy barriers to healthy urban development

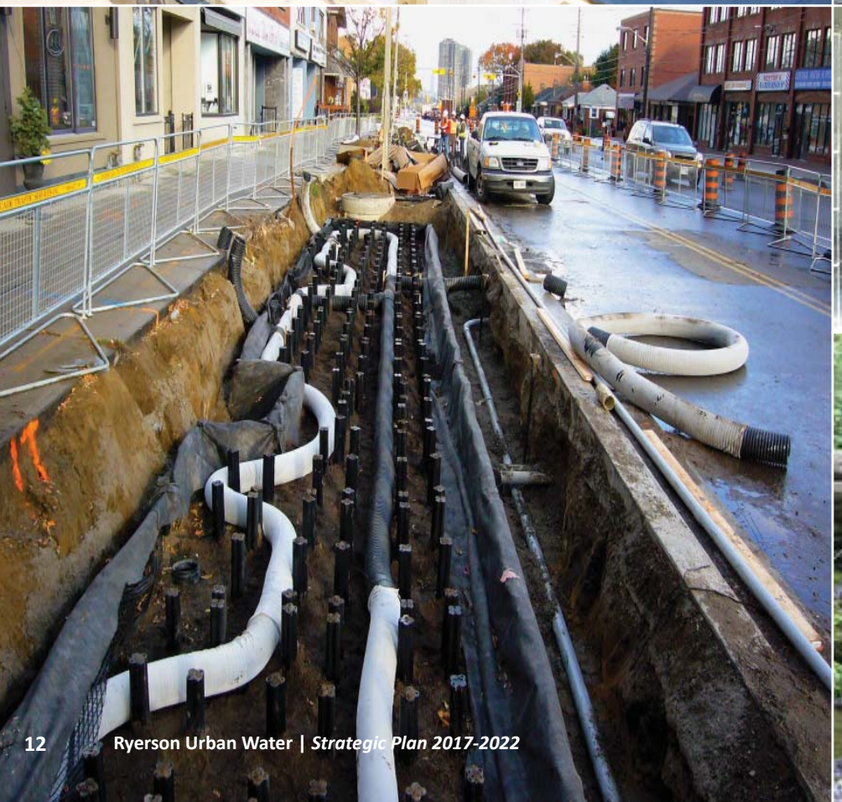


**THINK TANK**

- Engage and facilitate knowledge exchange through expert roundtables
- Formulation of best practices and positions that foster healthy water cycles
- Thematic surveys, white papers, and knowledge dissemination


**INCUBATION**

- Ryerson's learning zones create unique environments to partner, incubate, and innovate
- Social partnerships and commercialization of transformative solutions for healthy cities





**Over the next five years, the activities and initiatives of the faculty and staff of Ryerson Urban Water will be guided by six goals to achieve healthy water and healthy cities.**

# Goal One

*Establish RUW as the pre-eminent collaborative hub for excellence in **Applied Research** in solving urban water challenges.*

## OUTCOME

RUW will advance the transformation of communities to healthy urban environments by enhanced interdisciplinary research and integration with external partners.

*Photos in clockwise order L-R: **(1)** Hydraulic challenges associated with Ontario Power Generation led by Dr. James Li, **(2)** Wastewater technology enhancements led by Dr. Kim Gilbride and Dr. Otini Kroukamp. Photo: Evan Ronan, PhD student and August Guo, Bishop Water Technologies, **(3)** Spencer Crook MASc student on international exchange in The Netherlands, **(4)** Urban Forest Research & Ecological Disturbance Group led by Dr. Andrew Millward, **(5)** Low impact development led by Dr. James Li, Department of Civil Engineering.*

## ACTIVITIES

- Develop a decision-making tool that supports the evaluation of innovative technologies for urban water management intended for the master planning of new communities and redevelopments.
    - Establish a protocol to make tool accessible to all partners and collaborators.
- Develop a communications plan to build awareness of Ryerson Urban Water as a research hub.
    - Highlight the renovation of 44 Gerrard Street as the new Centre for Urban Innovation and home of Ryerson Urban Water.
- Facilitate increased interdisciplinary research among members of RUW.
    - Document RUW expertise, research programs, resources (e.g., lab equipment), and match funding opportunities with industrial partner needs.
    - Host collaborative events for RUW researchers to stimulate future research collaborations.
- Develop RUW Youth and RUW Associate Fellow Memberships.

# CENTRE FOR URBAN INNOVATION

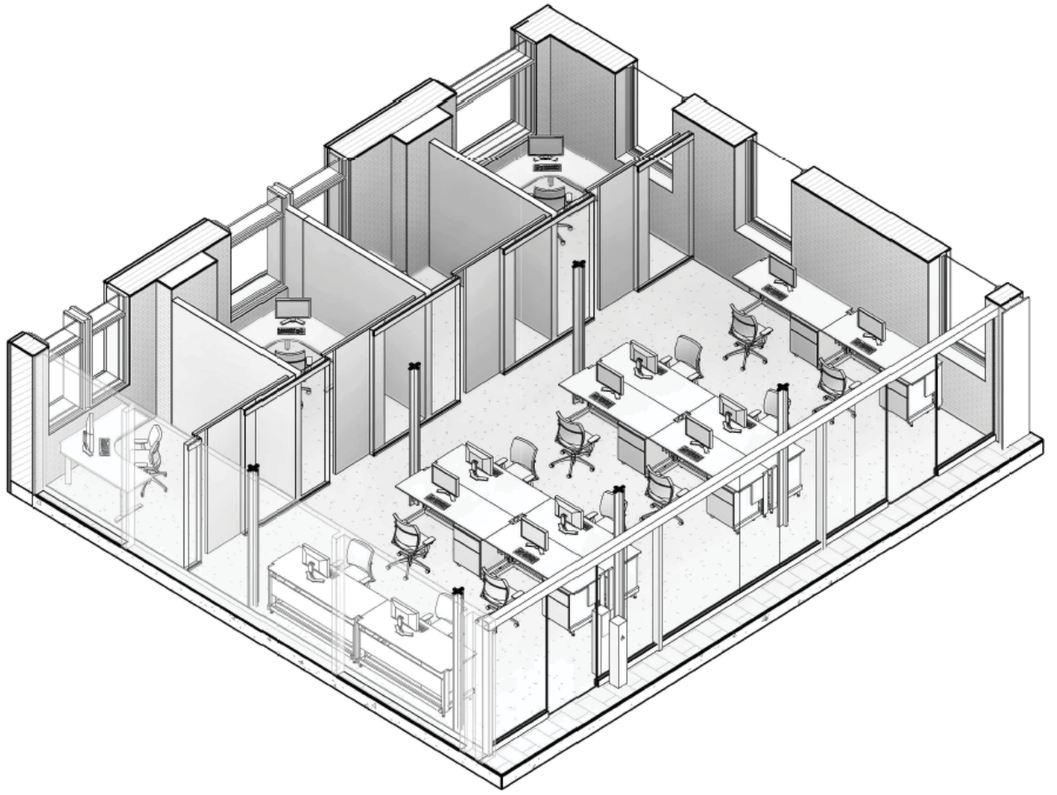
## A New Home for Ryerson Urban Water

*In 2018, Ryerson Urban Water will move into a fully renovated, dedicated space within the Centre for Urban Innovation. The Centre for Urban Innovation will house collaborative lab and office space for interdisciplinary research in water, energy, and food.* ***Courtesy of Moriyama and Teshima Architects.***

*Exterior of the Centre for Urban Innovation*

*RUW Hub*

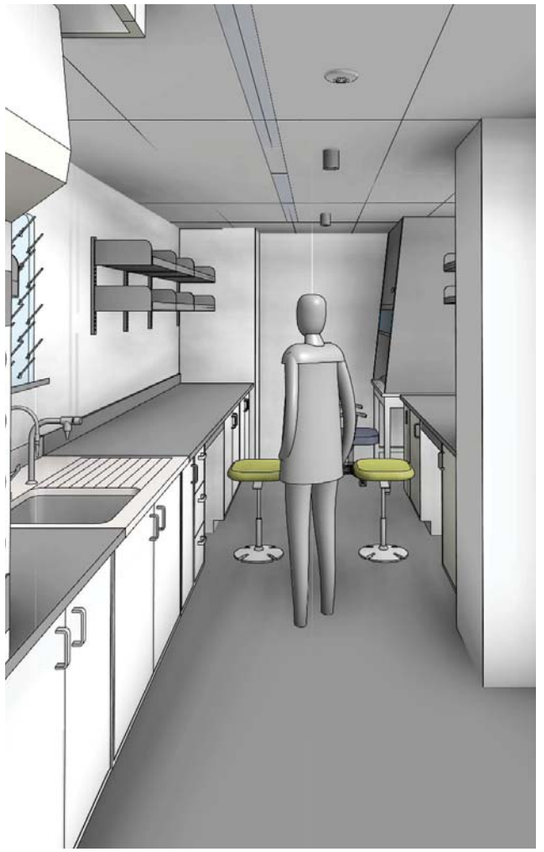
*The Atrium*



*RUW Hub*

*The Ryerson Urban Water Hub will be the space for collaborative planning, research analysis, and integration with centres for Urban Energy, Food Innovation, Data Analytics, and the Science Discovery Zone. Work stations will be equipped with tools to support data processing and analytics. Students and researchers will have access to highly specialized software.* ***Courtesy of Moriyama and Teshima Architects.***

*Collaborative Spaces are informal and will provide the space for spontaneous discussions with freeform writing surfaces on walls connecting students of different disciplines and subdisciplines. Cross-pollination happens here.* ***Courtesy of Moriyama and Teshima Architects.***



*Microbiology Lab*

*Water Analysis Lab*

*Wet Lab*

*Ryerson Urban Water will have a series of labs with the flexibility to research all aspects of a sustainable urban water cycle fundamental to healthy cities. These include drinking water, wastewater and stormwater management, environmental protection and restoration, resilient infrastructure, energy from waste, and local food production.* ***Courtesy of Moriyama and Teshima Architects.***

# Goal Two

*Establish RUW as a leader in delivering water **Education** through traditional and innovative approaches.*

Building on RUW's experiences of environmental education and outreach in Ontario, we will undertake a number of initiatives to support water literacy. This will be achieved through programs delivered in primary and secondary schools, supported by teacher education tailored to classroom instructors. A complementary Sustainable Urban Water program will be developed and delivered to professionals whose job responsibilities include urban water management.

## OUTCOME

An informed water-literate citizenry that supports decisions leading to sustainable urban watersheds.

***Photo (above):*** *SCInnovation at Ryerson April 2016.*
***Photos (right) in clockwise order L-R:***
***(1)*** *Architectural Design Competition on Water Interventions at Ryerson in January 2016,* ***(2)*** *SCInnovation at Ryerson April 2016. Dr. Lynda McCarthy with grade 8s,* ***(3)*** *Walk for Water on World Water Day March 2016,* ***(4)*** *SCInnovation at Ryerson April 2016. Amber Grant MASc student with Dr. Andrew Millward,* ***(5)*** *Walk for Water on World Water Day March 2016. Photo: Tyler Mifflin, WaterBros, Angela Murphy, RUW, Kerry Freek, WaterTAP, Alex Mifflin, WaterBros. SCInnovation photos courtesy of OCWA.*

## ACTIVITIES

- Develop a co-ordinated *Water Education Outreach* Program for primary and secondary schools delivered through RUW Researchers and Ryerson Student Mentors.
- Enhance environmental and water education in primary and secondary schools working with the Ministry of Education, Ministry of Advanced Education and Skills Development, and Ontario College of Teachers.
- Pre-Service Teacher Education:
  - Environmental and Sustainability Education.
  - Water Experts Workshop sharing best teaching practices.
- Deliver an Education Program through RUW for teachers, leading to a Graduate Certificate in *Sustainable Urban Water Education*.
- Chang School Continuing Education courses for municipal, provincial, and conservation professionals leading to a Graduate Certificate in *Sustainable Urban Water*.

# Goal Three

*Establish RUW as **the** urban water advisor on **Policy** strategies for all levels of government.*

As a University-based urban water centre, RUW is uniquely positioned to provide balanced, non-partisan guidance on urban water policy issues. Building on a solid foundation of environmental, economic, social, political, and legal research expertise, RUW can provide direction and leadership to support policy strategies for healthy urban water.

## OUTCOME

Fact based policy and regulation decisions that encourage and support sustainable urban water actions.

## ACTIVITIES

- Undertake thematic surveys to identify gaps in public understanding of urban water issues and requirements necessary to develop resilient sustainable cities.
- Roundtable with stakeholders to develop policy guidance in response to the thematic survey gaps.
    - Publish and disseminate findings.
- Develop a one-day conference for municipalities to share survey findings and advise on policy recommendations and align with an existing municipal event.


***Photo (left):*** *Dr. Carolyn Johns, Great Lakes Policy Researcher, Department of Politics and Public Administration.*

***Photos (above) in order L-R: (1)*** *Green Infrastructure Hackathon at Ryerson October 2016. Alex Gill, Social Innovation Zone, Tom Kaszas, MOECC, Sheila Boudreau, City of Toronto, Raad Seraj, WaterTAP,* ***(2)*** *Dr. Hitesh Doshi, Green Roof Strategies, Department of Architectural Science,* ***(3)*** *Architectural Design Competition on Water Interventions at Ryerson in January 2016. Judges Panel.*

# Goal Four

*Host **Think Tanks** to engage, analyse, and coalesce knowledge to inform decisions that advance healthy urban water cycles.*

No one entity holds all of the answers to developing and maintaining a healthy urban water cycle. Consequently, through Think Tanks and outreach, RUW will bring divergent stakeholders together and facilitate discussion, analyze the knowledge generated, and disseminate the outputs for all stakeholders to utilize.

## OUTCOME

Facilitate evidenced-based dialogue and decision making through the Ryerson Urban Water Hub, including online access and direct communications with researchers.

## ACTIVITIES

- Roundtables on key issues to identify best practices, make recommendations, and document solutions in White Papers.
- Disseminate findings such as RUW research, White Papers, presentations, and other resource materials through RUW networks.
- Support the University's strategic objectives of a sustainable and resilient campus by participation in capital projects, facility operations, procurement, and SRC (scholarly, research, and creative) activities.

***Photo (left):*** *Education Experts Workshop at Ryerson April 2015.*

***Photo (right):*** *RUW Board of Advisors on Ryerson green roof at May 2016 Meeting.*

# Goal Five

*Develop an **Incubation**, knowledge mobilization, and commercialization path to leverage opportunities arising from RUW projects.*

Ryerson is increasingly recognized as a focal point for innovative ideas and as an incubator of solutions that assist in building a "liveable city." Ryerson's Zone Learning creates transformative educational environments where tomorrow's urban leaders meet peers and subject matter experts together in a community that provides entrepreneurial thinking, creates access to resources, and develops skills for success. RUW will connect its activities to Zone Learning and ensure that we have a path from *idea to innovation to implementation*.

## OUTCOME

Seamlessly connect Ryerson resources so that research and innovative solutions can be developed and implemented to advance a healthy and sustainable urban water cycle.

*Photos in clockwise order L-R: **(1)** SCInnovation at Ryerson April 2016. Hon Elizabeth Dowdeswell, Lieutenant Governor of Ontario with grade 8s. Photo courtesy of OCWA, **(2)** Environmental and Urban Sustainability students considering Waterfront Toronto challenges, **(3)** Green Infrastructure Hackathon at Ryerson October 2016.*

## ACTIVITIES

- Introduction of RUW to all Zones through meetings with Zone Directors and hosting a Zone Mixer with RUW researchers.
- Identify an RUW member to be connected and active in each of the Zones (e.g., Science Discovery Zone, Digital Media Zone, Launch Zone, Biomedical Zone, Social Ventures Zone and others).
- Introduce our partners to the Zones as possible mentors and advisors.
- Invite at least one member from each Zone to participate in RUW events.




# Goal Six

*Secure a **Sustained Funding Model** for RUW for the next 5 to 10 years.*

The activities associated with our goals are largely unfunded at present and financial support for each is pursued from individual funding sources. Notwithstanding that faculty and staff will continue to seek funding for individual projects, it is essential that RUW establishes a sustainable funding formula for both the short and long-term outlook.

## OUTCOME

Ryerson Urban Water will have the financial resources to deliver the goals and activities of this strategic plan.

*Photos in clockwise order L-R: **(1)** Green Infrastructure Hackathon at Ryerson October 2016. Organizing committee, **(2,3)** Green Infrastructure Hackathon at Ryerson October 2016, **(4)** RUW and Toronto Water engineers at Ashbridges Bay Wastewater Treatment Plant.*

## ACTIVITIES

- Clearly articulate the value proposition of RUW on the website and prepare communications materials.
- Develop an interim internal funding mechanism to support RUW that demonstrates institutional commitment to RUW and its role within the Centre for Urban Innovation.
- RUW Staff work with key members of the RUW Executive Team to develop a persuasive presentation for long-term funding to achieve our goals.
- Communicate the depth and breadth of our collective expertise to targeted supporters and obtain a financial commitment to achieve the goals of Ryerson Urban Water.

# ADVANCING OUR PLAN

On an annual basis, RUW will report on its metrics, describing the activities undertaken, results achieved, progress towards its long-term goals, and course corrections along the way.

Over the next five years, we will use this Strategic Plan to develop annual blueprints for funding applications, research priorities, commitments to activities, and prioritization of outreach events. The Strategic Plan will guide us in responding to funding opportunities at both provincial and federal levels for clean-tech innovations and adaptation strategies for climate change, protection of watersheds, carbon footprint, carbon trading, and green infrastructure.

Many projects will be delivered at the municipal level, where public engagement, education, and guidance are fundamental and indispensable if healthy urban water strategies are to be successfully implemented.

We shall track our activities and report on performance at the end of each fiscal year. Each activity will have one or more Key Performance Indicators, and the sum of the completion of these indicators will show our accomplishments toward achieving our goals.



# IN CONCLUSION

*Achieving the security of healthy water and healthy cities demands a fresh novel approach that integrates engineered, scientific, economic, environmental, societal, and policy strategies. RUW will lead by example and provide stewardship to the Ontario ecosystem in this transformative approach.*

As detailed in this Strategic Plan, RUW will deliver critical research identified by the sector, education programs, and policy strategies to promote sustainable urban water management. Through think tanks and engagement, RUW will facilitate discussion, analyze the knowledge generated, and disseminate the outputs for all stakeholders to utilize. As well, we will develop an incubation, knowledge mobilization, and commercialization path for innovative opportunities arising from RUW projects. Through these outcomes, RUW will lead by example and be part of the transformative change necessary to achieve healthy water and healthy cities.

***Photos in clockwise order L-R: (1)*** *Green Infrastructure Hackathon at Ryerson October 2016. Angela Murphy, Dr. Andrew Laursen, Dr. Lynda McCarthy,* ***(2)*** *SCInnovation at Ryerson April 2016. WaterBros and Dr. Michal Bardecki,* ***(3)*** *SCInnovation at Ryerson April 2016. Dr. Andrew Laursen with grade 8 students,* ***(4)*** *SCInnovation at Ryerson April 2016. Dr. Vadim Bostan with grade 8 students. SCInnovation photos courtesy of OCWA.*



## Table 1: Ryerson Urban Water Experts

### Water Policy and Ethics, Society and Communications

- Green resilient city policy
- Inter-jurisdictional policy and regulation
- Comparative water policy
- Water use and corporate social responsibility
- Socio-ecological systems
- History of water technology
- Science communication

*Michal Bardecki, Sara Edge, Christopher Gore, Ingrid Hehmeyer, Carolyn Johns, Ron Pushchak, John Shiga, Kernaghan Webb, Alex Wellington*

### Watershed, Water Quality, Data Analytics

- Urban Impacts on Great Lakes
- Organisms as sentinels of climate change
- Urbanizing Watersheds
- Industrial wastewater and microbial genomics
- Treatment wetlands
- Geospatial analysis and big data

*Michael Arts, Vadim Bostan, Lesley Campbell, Elsayed Elbeshbishy, Martina Hausner, Darrick Heyd, Janet Koprivnikar, Otini Kroukamp, Andrew Laursen, Julia Lu, Grace Luk, Lynda McCarthy, Mehrab Mehrvar, Stephanie Melles, Claire Oswald, Gideon Wolfaardt*

### Green Infrastructure, Resilient Cities

- Water management
- Water and wastewater treatment
- Sewerage capacity
- Green urban infrastructure
- Resilient planning
- Water and energy optimization
- Green roofs, urban forests
- GIS modelling
- Smart analytics

*David Atkinson, Hitesh Doshi, Liping Fang, Darko Joksimovic, James Li, Nina-Marie Lister, Mohammad Manshouri, Andrew Millward, Pamela Robinson, Ahmed Shaker*

### Public Health and Contaminants

- Human health risks of climate change
- Disaster management
- Municipal wastewater pathogens
- Exposure of First Nations peoples
- Heavy metal pollutants

*Kim Gilbride, Eric Liberda, Corinne Ong, Thomas Tenkate*

*Photo (left): Ashbridges Bay Wastewater Treatment Plant. Photo courtesy of Angela Murphy, Manager, Research and Partnerships, Ryerson Urban Water.*

*Dr. Lynda McCarthy is the inspiration and Founder of Ryerson Urban Water. Dr. McCarthy is an eminent Great Lakes Ecotoxicologist and Professor at Ryerson University.*

# Research, Education, Policy: Healthy Water. Healthy Cities.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