GLOBAL WATER FUTURES OBSERVATORIES

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Global Water Futures Observatories – Status, Progress, and Activities January 2026

John Pomeroy,

GWFO Director, University of Saskatchewan

GWFO Operations Team Workshop, January 14 & 16, 2026

University of Saskatchewan · University of Waterloo · McMaster University · Laurier (Inspiring Lives.) · Carleton University · University of Toronto Scarborough · Trent University · Western University · Canada · University of Windsor

Canada's Water Crisis in the 21st Century

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GLOBAL WATER FUTURES OBSERVATORIES
www.gwfo.ca

Rapid Glacier Loss and Reduced Snowpacks

Rates of loss of western Canadian glaciers have doubled in recent years compared to 2010–20. Canada is experiencing shorter snow seasons, less snow accumulation, and faster spring melts.


Peyto Glacier
Canadian Rockies

Increasing Wildfires

Trends are starkly clear in the growing extent and severity of wildfire and an earlier start of the fire season. The wildland–society interface is at perilous risk across much of Canada.


Wildfire in Manitoba, May 2025

Global Water Futures Observatories (GWFO) support and conduct critical water research to safeguard Canadian water resources in an era of rapid change.


Acid drainage, Tombstone Mtns., YT

Release of uranium and arsenic from thawing permafrost threatens Yukon water supplies

1/3 of Jasper, AB burned (Jul 2024) over $1.2B damages

Yellowknife, NT evacuated due to encroaching wildfire (Aug 2023)

Unprecedented meltwater flooding in Whitehorse and Southern Lakes area, YT (Jul 2021)

Unprecedented ice jams and flooding, Hay River, NT (May 2022)

Fort McMurray wildfire (May 2016) $10B damages—costliest disaster in Canadian history

Diversion of Slims River and loss of inflow to Kluane Lake, YT due to glacier retreat

Calgary hailstorm (Aug 2024) nearly $2.8B insured losses

Lytton, B.C. destroyed by wildfire after record-setting 49.6°C air Temp. (Jun 2021)

17.3M hectares of forest burned in Canada in 2023—about the size of New Brunswick and Nova Scotia combined—with estimated cost of over $3.1B

Over 68,800 evacuated and devastating losses by wildfire from coast-to-coast, particularly the Prairies and Atlantic (2025). This was the 2nd-worst wildfire season after 2023

Harmful algal blooms threaten Lake Winnipeg and many other Prairie lakes.

Recurring water crises in Iqaluit due to shortages and contamination

Post-tropical cyclone Lee (Sep 2023); strong winds, heavy rain, flooding, power losses

B.C. Lower Mainland Flood (Nov 2021) estimated $7.5B damages

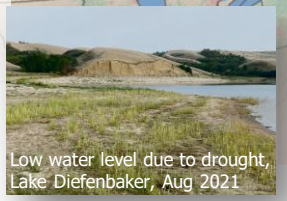
Prairie drought, 1999–2004, cost $5.8B

Saskatchewan crop insurance payout of $2.1B in 2021

Southern AB Flood (Jun 2013) over $5B damages, 100,000 evacuees

Severe and Sustained Droughts

Multiple recent extreme droughts have occurred with widespread impacts from water shortages to crop failures and wildfires.

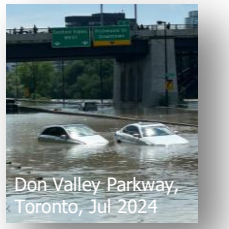

Low water level due to drought, Lake Diefenbaker, Aug 2021

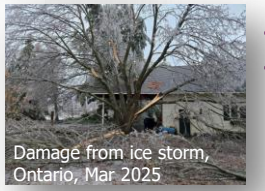
Pan-Canadian droughts in 2021, 2023 in combination with excessive heat and vast wildfires

As of 2025 there are 37 long-term drinking water advisories in 35 Indigenous communities in Canada.

Catastrophic Flooding

Floods due to heavy rainfall, rapid snow and ice-melt, and river ice jams have caused substantial damages across Canada in recent years.


Don Valley Parkway, Toronto, Jul 2024


Damage from ice storm, Ontario, Mar 2025

Severe Storms and Hazardous Precipitation

Climate warming has led to more moisture in the atmosphere and more intense storms with heavy precipitation and damaging hail. Conditions near 0°C remain common, with associated freezing rain and other hazards.

Damaging flood in NS and NL (Nov 2021), washing out roads and Trans-Canada HWY

Freezing rain in Montreal and parts of ON and QC (Apr 2023 and Mar 2025) $1B insured losses

Floods in Toronto (Jul 2013 and Jul 2024) about $1B damages each

Threats to Water Quality and Aquatic Ecosystems

Excess nutrient runoff and other contaminants pose a major risk to water bodies across the country. Invasive species threaten local aquatic ecosystems and pose significant management problems.

Economic costs of eutrophication estimated $270M per year for the Canadian side of Lake Erie.


Algal bloom, Lake Erie

University of Saskatchewan | University of Waterloo | McMaster University | Laurier | Carleton University | University of Toronto Scarborough | Trent University | Western University | University of Windsor

Global Water Futures Observatories 2023-2029

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University of Saskatchewan

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Laurier Inspiring Lives.

Carleton University

University of Toronto Scarborough

Trent University

Western University · Canada

University of Windsor

Global Water Futures Observatories (GWFO)

National research facility of world class observation sites and laboratories

Global Water Futures Observatories (GWFO)

https://gwfo.ca/

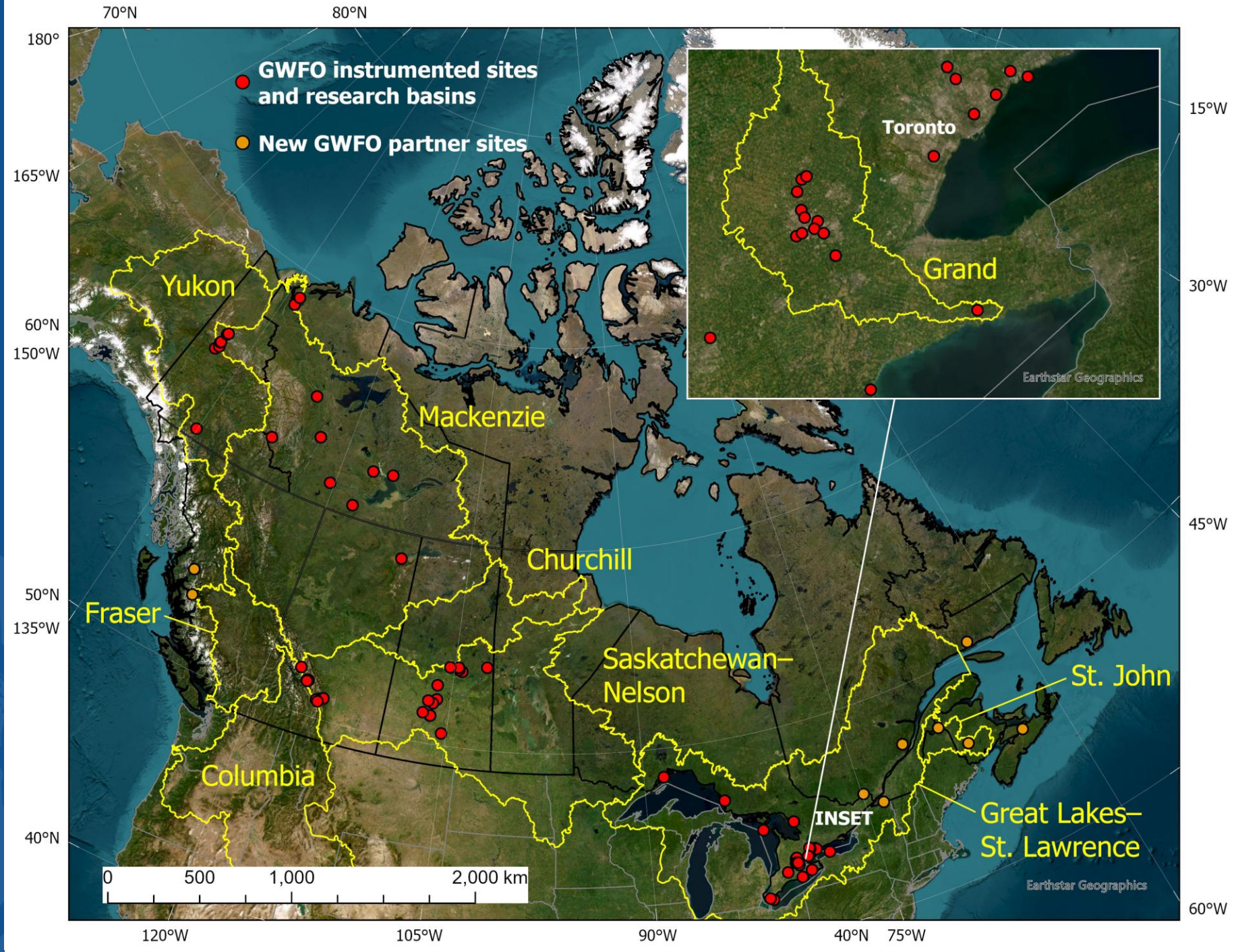
Great Lakes

Prairies

Rockies

North

$75 M Infrastructure
64 instrumented basins
15 deployable systems
18 major water laboratories
4 major river basins
49.25 HQP



GLOBAL WATER FUTURES OBSERVATORIES

By The Numbers

(2023-2025)

Awarded **$ 15.25 M** over 6 years **2023-2029** from **INNOVATION** Canada Foundation for Innovation / Fondation canadienne pour l'innovation

Nationwide Network

64 Freshwater Observatories

18 Water Laboratories

15 Deployable Systems

Partner Institutions

University of Saskatchewan · University of Waterloo · Laurier · McMaster University · Carleton University · University of Toronto · University of Windsor · Trent University · Western University · Canada

Current Data & Facility Users

2024 - 2025

26,400

Scientific Outputs

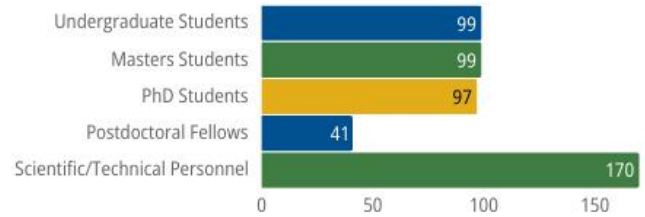
1,546

- **478** peer-reviewed publications
- **817** conference presentations
- **31** databases, code, software
- **109** newsletter and magazine articles
- **7** conference proceedings
- **16** technical / consultancy reports
- **17** books/chapters
- **71** student theses

Currently Supports

506 Highly Qualified Personnel

2024 - 2025



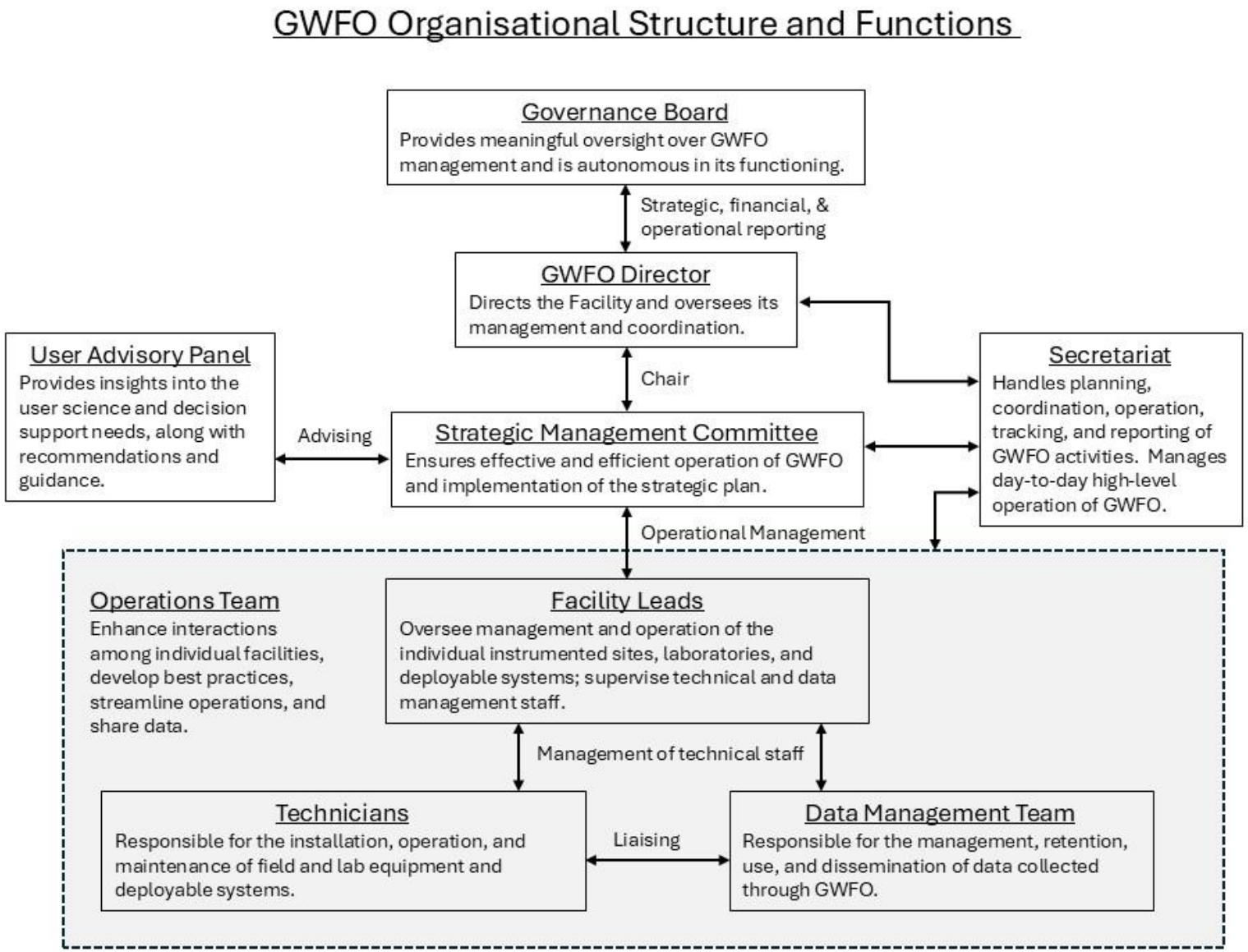
Outreach

- **142** courses, workshops, training
- **63** stakeholder or public events
- **293** media interviews, broadcasts, podcasts

External Collaborators

United Nations · WMO · WCRP World Climate Research Programme · UNESCO · CIROH · Bridge to Land Water Sky · GEWEX

GWFO Governance and Management



GWFO Governance Board

The GWFO Governance Board provides meaningful oversight over GWFO management and is autonomous in its functioning. It holds the facility to the highest standards of operational excellence, promotes broad engagement among the partners and users, and ensures finances are well-managed.

Rodney Bouchard
CEO and General Manager, Union Water Supply System Inc., ON

Aimée Craft
Professor, Faculty of Law, University of Ottawa; Chair, Manitoba Clean Environment Commission

Charmaine Dean
Vice President Research, University of Waterloo

Terry Fonstad
Associate Vice President Research, University of Saskatchewan

Deidre (Dee) L. Henne
Chief Financial Officer, University of Saskatchewan

Stephen Stanley, Board Chair
Senior Vice President Strategic Initiatives, EPCOR (ret.)

Wayne Jenkinson
Executive Director, National Hydrological Service, Ottawa

Heather Jirousek
Director, Water Resources Branch, Yukon Environment

Harvey Locke
Conservationist, writer, photographer
President, Harvey Locke Conservation Inc., Banff

Deborah McGregor
CERC in Indigenous Environmental Justice, University of Calgary

Michael Nadler
CEO, Ducks Unlimited Canada (DUC)

Thon Phommavong
VP of Science and Licensing, Saskatchewan Water Security Agency

GWFO Strategic Management Committee

The GWFO SMC is responsible for providing direction and ensuring optimal operations and utility towards supporting monitoring and transformational science, managing GWFO finances and budget, and providing recommendations to the Board for allocating resources.

Jennifer Baltzer
Wilfrid Laurier University

Helen Baulch
University of Saskatchewan

Sean Carey
McMaster University

Aaron Fisk
University of Windsor

Lawrence Martz
University of Saskatchewan
Professor Emeritus

John Pomeroy, SMC Chair
University of Saskatchewan

Al Pietroniro
University of Calgary

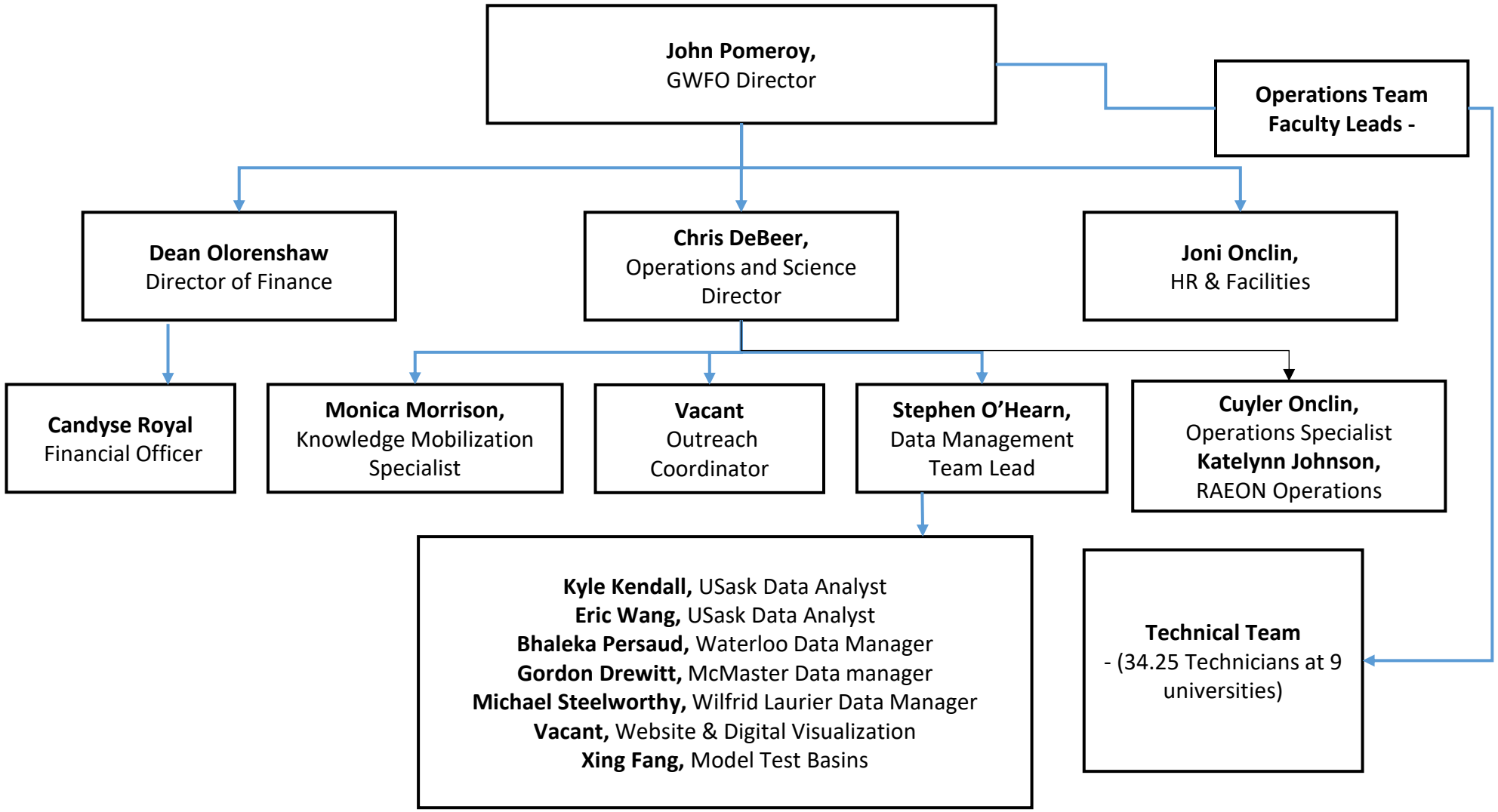
Dave Rudolph
University of Waterloo

Corinne Schuster-Wallace
University of Saskatchewan

Julie Thériault
Université du Québec à Montréal

Philippe Van Cappellen
University of Waterloo

GWFO Secretariat, Data Team & Technician Management



GWFO Vision

To operate a national freshwater research facility that supports critical water research to safeguard Canadian water resources in an era of rapid change.

GWFO Principles of Operation

- **To provide unique water data** of interest to characterizing and monitoring the water conditions of Canadian river basins.
- To contribute to a **critical baseline of water data** to the benefit of multiple users.
- To support the data collection from, and analysis of water from a pan-Canadian network of **instrumented water observing sites.**
- To adhere to the **principles of open access.**

GWFO Objectives

- **Objective 1: Provide unique and high-quality water data and analytical capabilities to characterize Canadian freshwater conditions and support world-leading water science**
  - *Monitor and help support the development of solutions for Canadians and to provide the observational and analytical data that underpins transformative science and advances the understanding of hydrological and ecological systems and their interconnections.*

- **Objective 2: Support water-related disaster warning and assessment of risks to water quality**
  - *Act as an early warning system for water disasters and provide data support for adaptation to climate change and associated risk management in user groups and communities across Canada.*

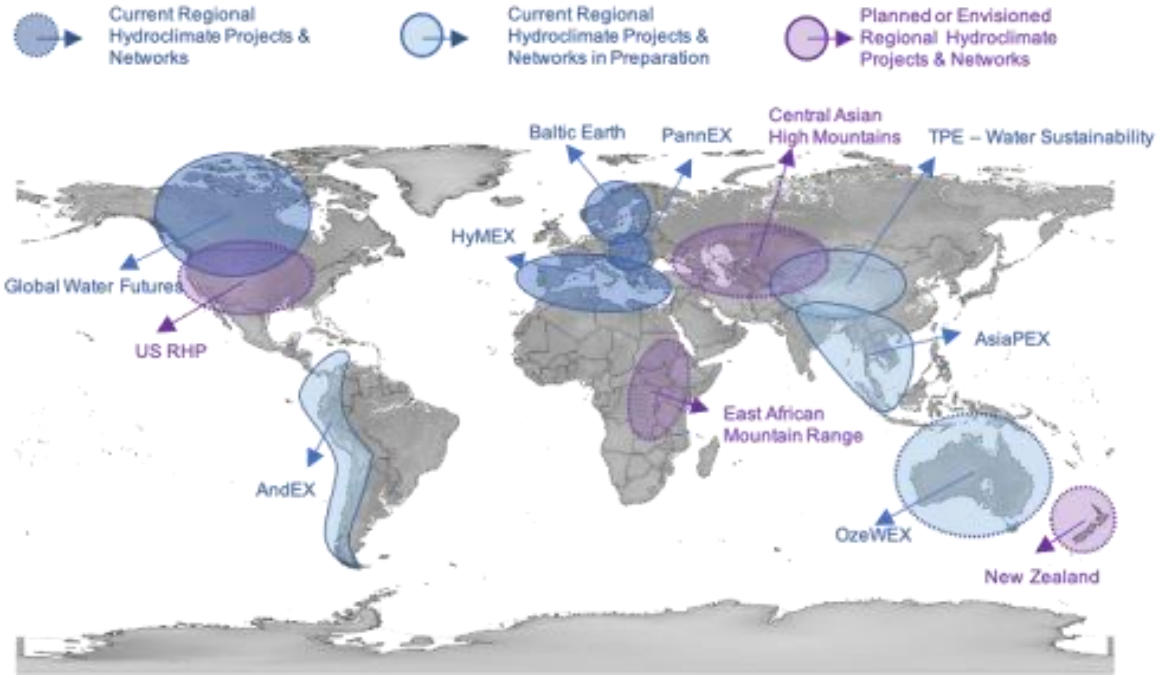
- **Objective 3: Meet the needs of a diverse range of users, partners, and communities**
  - *Provide the data, services, and expertise for developing decision support systems, monitoring and planning, and help in the design of solutions to allow water users, stakeholders, and rightsholders to adapt to the changing climate and achieve water sustainability.*

GWFO Mission

- Operate as **Canada's premier national freshwater research facility** in support of national water management through governments, industry and communities
- Provide **essential data** for researchers and others to develop sustainable water resource management solutions
- **Inform development** and evaluation of computer modelling and analytical tools for water-related disaster warning and water quantity and quality predictions
- **Support prediction** of future water flows and quality and quantitative support for adaptation to climate change and risk management
- **Disseminate freshwater data** to provincial, territorial and federal government agencies, industry, agriculture, communities and other researchers
- **Support finding solutions** to user-defined questions that will help Canada and the world achieve water sustainability in a time of rapid global change.
- **Provide deep water data** from water observations, managed using a state-of-the-art system, to a wide range of users

GWFO as the foundation of ongoing Canadian Regional Hydroclimate Project for GEWEX (Global Energy and Water Exchanges) Programme

- GEWEX RHPs are generally large, regionally-focused multidisciplinary projects that aim to improve the understanding and prediction of that region's weather, climate, and hydrology.
- GWFO allows Canada to maintain its important contributions to GEWEX and provide global scientific leadership



The only active RHP in North America and one of a few in the world. GEWEX has viewed this as an exemplary RHP and a model for others.

GEWEX

Canada's Regional Hydroclimate Project for GEWEX: Transitioning from the Global Water Futures Programme to the Global Water Futures Observatories Facility

John Pomeroy and Chris DeBeer

Centre for Hydrology and Global Institute for Water Security, University of Saskatchewan, Saskatoon, Canada

History

Canada has a long history of involvement and contributions to GEWEX dating back to the early 1990s, when regional hydroclimate projects (RHPs) were formed around coordinated research activities in major cold regions river basins of western Canada. The Mackenzie GEWEX Study (MAGS; https://gwfnet.net/sites/mags/) was an early Canadian contribution to GEWEX that focused on the 1.8 million km² Mackenzie River Basin and had the objectives to 1) understand and model the high-latitude water and energy cycles that play roles in the climate system, and 2) improve our ability to assess the changes to Canada's water resources that arise from climate variability and anthropogenic climate change (Stewart et al., 1998; Woo et al., 2008). The study was carried out between 1994 and 2005 and produced the first comprehensive large-scale assessment and synthesis of cold region atmospheric and hydrologic processes in northern Canada.

The Saskatchewan River Basin (SaskRB) RHP commenced in 2012 and was expanded in 2014 to include the Mackenzie River Basin as part of the Changing Cold Regions Network (CCRN; https://ccrnetwork.ca/) research programme. This broader RHP for western Canada had the overall aims to integrate existing and new sources of data with improved predictive and observational tools to understand, diagnose, and predict interactions amongst the cryospheric, ecological, hydrological, and climatic components of the changing Earth system at multiple scales, with a geographic focus on western Canada's rapidly changing cold interior (see DeBeer et al., 2021, and the *HESS* special issue, https://hess.copernicus.org/articles/special_issue919.html).

CCRN ended in early 2018, but at that time the new Global Water Futures (GWF; www.globalwaterfutures.ca) programme provided an opportunity to expand this RHP geographically across Canada and as a more broadly-based and interdisciplinary initiative. The GWF Canadian RHP commenced that year with its coast-to-coast-to-coast domain covering the Yukon, Mackenzie, Fraser, Columbia, Saskatchewan–Nelson, Great Lakes–St. Lawrence, and Saint John River Basins, including transboundary portions of these basins in the United States. This encompassed a vast range of physiographic and climatological regions, from the Sub-Arctic Taiga, Tundra, and southern Arctic, through the western Cordillera, the vast Boreal Forest, the northern Prairie region, the Great Lakes, the St. Lawrence lowlands, and the Maritime region in the east.

The Global Water Futures Programme

GWF was conceived in 2015 to address a grand challenge for water science in Canada and globally: 'How can we best prepare for and manage water futures in the face of dramatically increasing risks?' With a $78M investment from the Canada First Research Excellence Fund (CFREF) and significant leveraged support from its lead partner institutions [University of Saskatchewan (USask), University of Waterloo, McMaster University, and Wilfrid Laurier University], GWF aimed to position Canada as a global leader in water science for the world's cold regions and to provide strategic tools to manage water futures for Canada and the world. It was a major undertaking to develop and operate this large university-led, transdisciplinary, multi-institutional water research programme, and much of what was done was new and unique. A recent paper describes how GWF did this and shares some of the important lessons learned and reflections (DeBeer et al., 2025).

With end-user needs at the forefront, driving GWF strategy and shaping its science, GWF focused on three main objectives:

1. Deliver new capability for providing disaster warning to governments, communities, and the public, including Canada's first national flood forecasting and seasonal flow forecasting systems, new drought warning capability, and water quality models and monitoring that warn of hazards to health and drinking water supply;
2. Diagnose and predict water futures to deliver improved scenario forecasting of changing climate, landscape, and water for the future, with information outputs tailored to the needs of users; and
3. Develop new models, tools, and approaches to manage water-related risks to multiple sectors, integrating natural sciences, engineering, social, and health sciences to deliver transformative decision-making tools for evidence-based responses to the world's changing cold regions.

GWF sustained the work of 65 research projects and core teams. Its research projects were selected through a competitive peer-reviewed process with the help of an International Science Advisory Committee. Indigenous community projects were co-developed and co-led with the communities and evaluated by an Indigenous Engagement Committee. GWF's core teams provided programme support in communications, data management, and knowledge mobilisation, and led strategic developments such as new computer modelling and collecting observations from over 70 instrumented research sites. GWF's four partner universities hired 40 new freshwater professors, and the funding provided to more than 200 faculty members at 23 universities across Canada led to the hiring and training of over 1700 undergraduate and graduate students, postdoctoral fellows, research scientists, technicians, and visiting scientists in groundbreaking scientific research. The research findings generated by this increased capacity are beginning to change freshwater and climate adaptation policy priorities and management practices across Canada and are providing the foundation for the country's essential climate and water prediction capability.

See page 4 of GEWEX Quarterly, Vol. 35, No. 4, 2025
https://www.gewex.org/gewex-content/uploads/2025/12/Q42025.pdf

GWFO Expansion

GWFO needs to define itself as Canada's ***national*** freshwater research observing facility

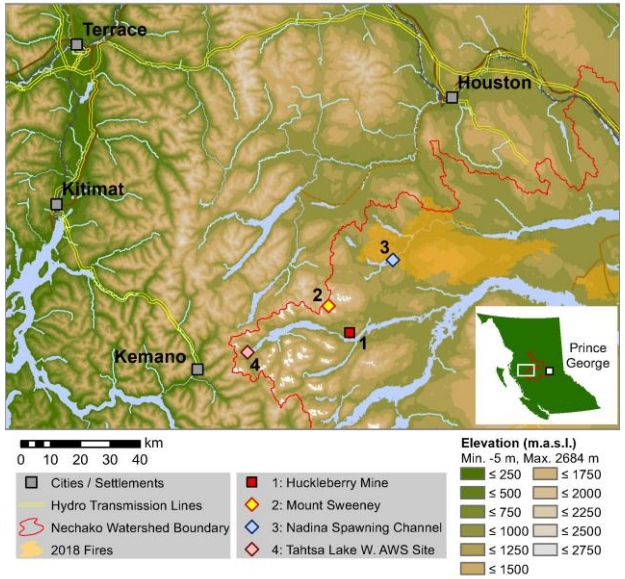
In-kind, mutually supportive relationships are sought with university and other partners

Instrumented research sites	Shared data management, outreach and knowledge mobilisation	No exchange of funds

Expansion of partnerships and facilities

- GWFO is expanding the network of observing sites through collaborative partnerships to cover more of Canada
- Progress in negotiating partnerships with the University of Northern British Columbia (UNBC), the Université du Québec à Montréal (UQAM), and the University of Calgary.

UCalgary sites include XL Ranch, Fortress Mountain, Lake O'Hara, and West Nose Creek



"Monitoring Extreme Climate and Hydrometeorological Events" or MECHE observatory

CANO also includes Université Laval, Dalhousie University, Université du Québec en Outaouais

Global Water Futures Observatories

https://gwfo.ca/

Great Lakes

Saint Lawrence

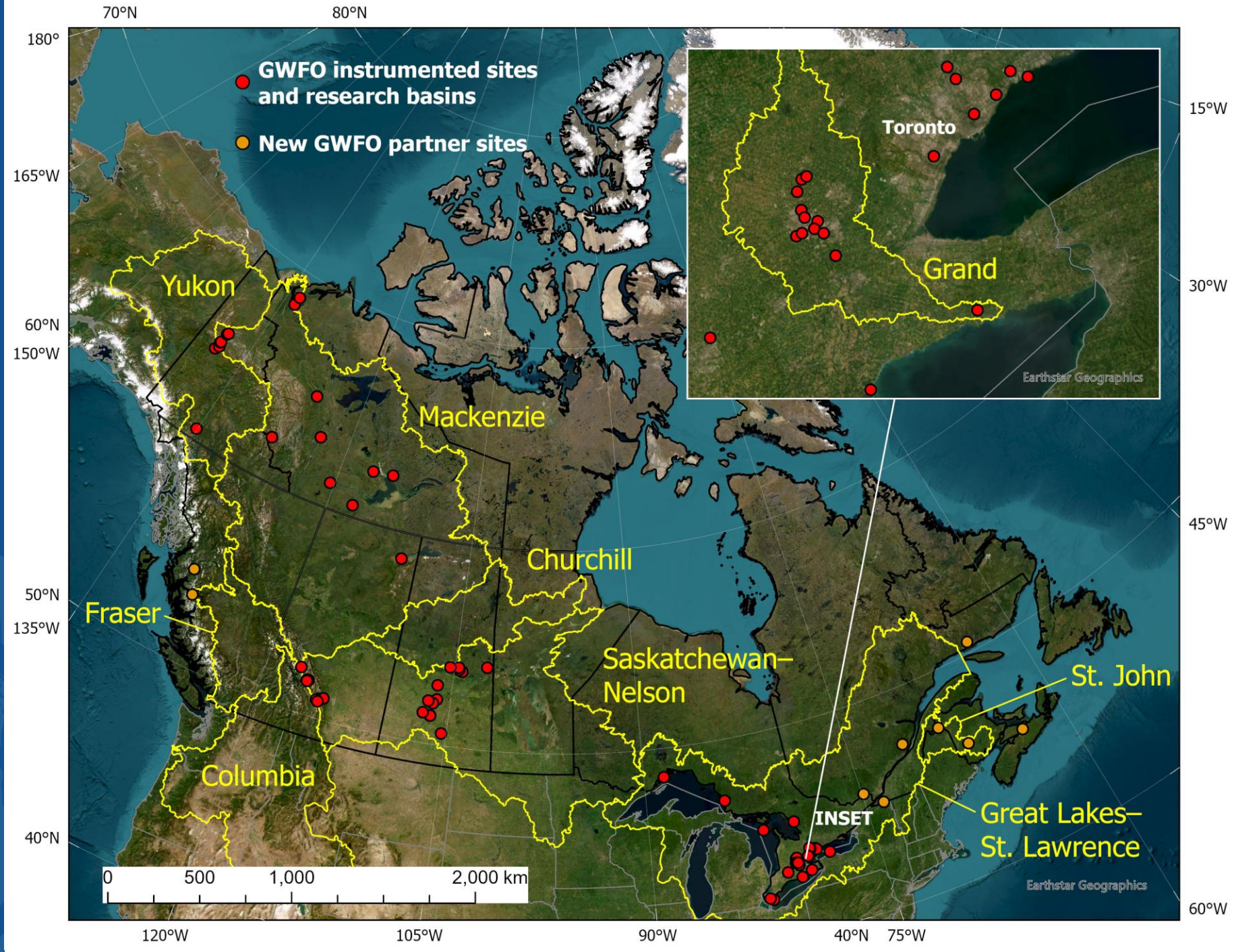
Maritimes

Prairies

Western Cordillera

North

$75 M Infrastructure
8 major river basins
49.25 HQP



GWFO at the Senate of Canada
October 2025

GWFO and the Minister of Environment and Climate Change
October 2025 @ University of Manitoba
Strengthening National Water Security and Resilience Roundtable

Meeting the Challenge

- Canada is in a **water crisis** and needs urgent action
- GWFO offers a **partnership** to the Canada Water Agency and Environment and Climate Change Canada for water monitoring, observations, data management for research, prediction, outreach and policy

GWFO Proposed Solutions

- **Invest in water monitoring for more accurate prediction**
  - Enhance and coordinate provincial/territorial, federal, university and related community **water observations** – *National Freshwater Data Strategy*
  - Support development of cutting-edge, **forecasting and prediction** of droughts and floods and associated water supply, wildfire risk, flood plain risk, irrigation scheduling, hydro potential and water apportionment. Beyond Bill C-241 – **a** *National Water Prediction System* coordinated by the Canada Water Agency
  - Nurture **partnerships**
    - Universities can contribute in partnership with the Canada Water Agency and ECCC.
    - United Nations water sustainability agenda – cryosphere decade, prediction, risk reduction

- **Adapt via solutions** – as part of a renewed **National Water Strategy**
  - Solutions developed for greater **resiliency** to water-based impacts of extremes from climate change and development: water for people, water for food, water for energy and water for environment
  - Safer, more reliable operation of **water infrastructure**: water storage, ecosystem conservation, irrigation, energy, industrial use, community use and flood protection

Meeting the Challenge

Our economy and healthy society depend upon freshwater. Canada is getting warmer and wetter with increasing extremes of drought and flooding: increasing costs of floods and droughts impoverish Canadians and impede nation building.

- **Supporting economic growth and ecosystem conservation depend on better predicting water supply for adaptation to climate change.** New observation and prediction capabilities are being developed and must be coordinated and deployed operationally to support adaptation and reduce risk.
- **Universities have a key role:** they can bring national freshwater observing systems, science innovations, early warnings, predictions and freshwater data management resources to the table. GWFO offers to partner with the Canada Water Agency and Environment and Climate Change Canada to provide long term support to their missions.