



Global Water Futures

Professor John Pomeroy,
Director, Global Water Futures Program



UNIVERSITY OF SASKATCHEWAN

Global Water Futures

GWF.USASK.CA



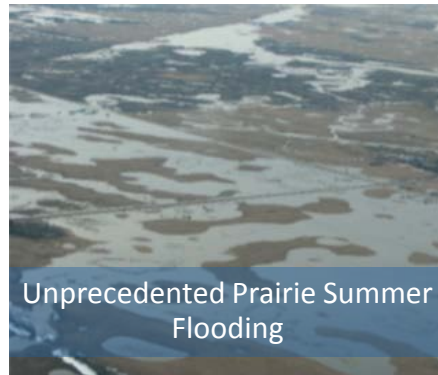
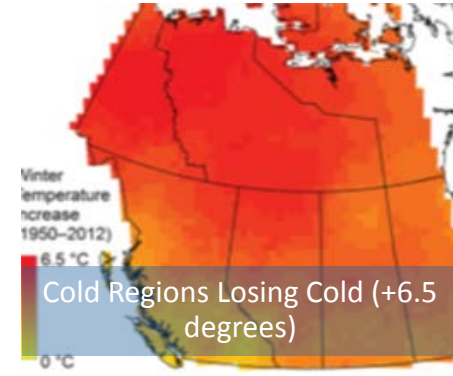
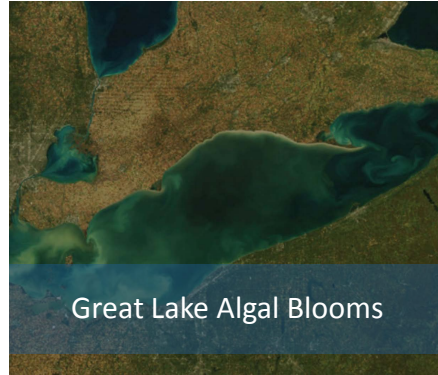


Water is essential for life and society





Our water is increasingly at risk



Climate Change

Urban and Industrial Development

Agricultural Intensification



Adaptation to change and threat mitigation requires

- **New science**
- **New prediction tools**
- **New monitoring systems**
- **More engagement with all Canadians**
- **More effective mechanisms to translate new scientific knowledge into societal action**

Global Water Futures: Solutions to Water Threats in an Era of Global Change



**CANADA
FIRST**
RESEARCH
EXCELLENCE
FUND

**APOGÉE
CANADA**
FONDS
D'EXCELLENCE
EN RECHERCHE

- Canada First Research Excellence Fund Competition \$1.5B CDN
- **Global Water Futures 2016-2023**
 - \$78 M CDN grant
 - \$143 M CDN initial program budget



**UNIVERSITY OF
SASKATCHEWAN**



**UNIVERSITY OF
WATERLOO**



University of Guelph

University of British Columbia

University of Northern British Columbia

University of Calgary

University of Laval

McGill University

University of Quebec at Montreal

University of Alberta

University de Montreal

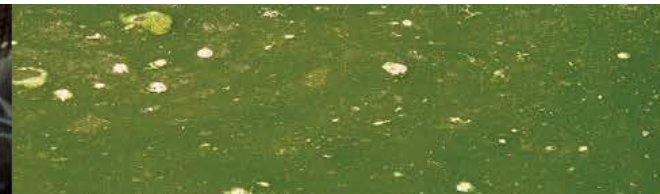
University of Manitoba

University of Victoria

Brock University

Canadian Rivers Institute (University
of New Brunswick & University of
Prince Edward Island)

Yukon College





Global Water Futures: Solutions to Water Threats in an Era of Global Change

GWF aims:

- a) to **place Canada as a global leader in water science for cold regions,**
- b) to **address the strategic needs of the Canadian economy** in adapting to change and managing the risks of uncertain water futures and extreme events.

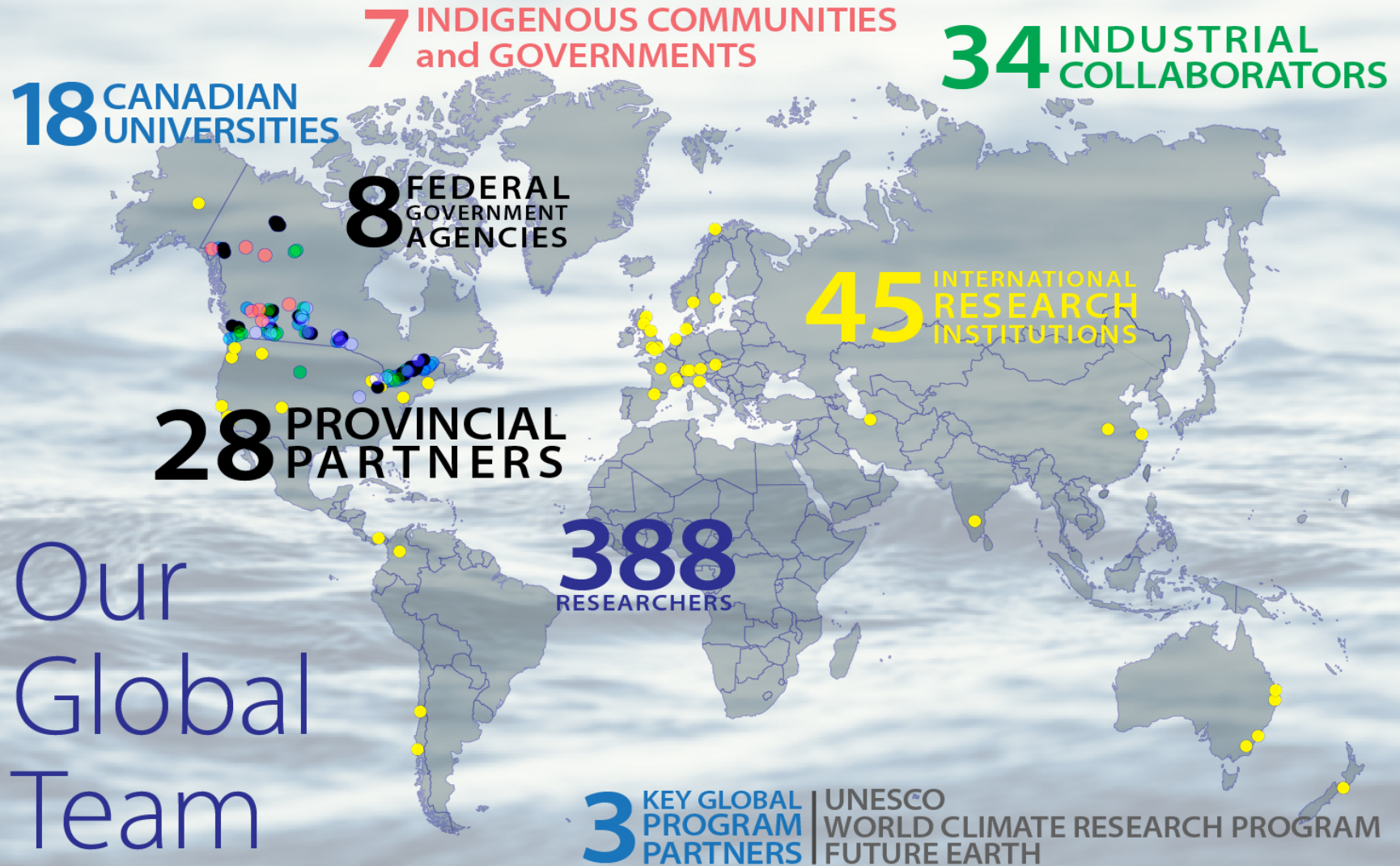
Global Water Futures - Mission



- **Improve disaster warning – develop:**
 - scientific knowledge, monitoring and modelling technologies,
 - national forecasting capacity to predict the risk and severity of extreme events
- **Predict water futures –**
 - use Big Data to make informed decisions,
 - Develop better models to assess change in human/natural land and water systems
- **Inform adaptation to change and risk management – to reduce the risk of water threats, design adaptive strategies, and enhance economic opportunities, propose**
 - governance mechanisms,
 - management strategies,
 - policy tools

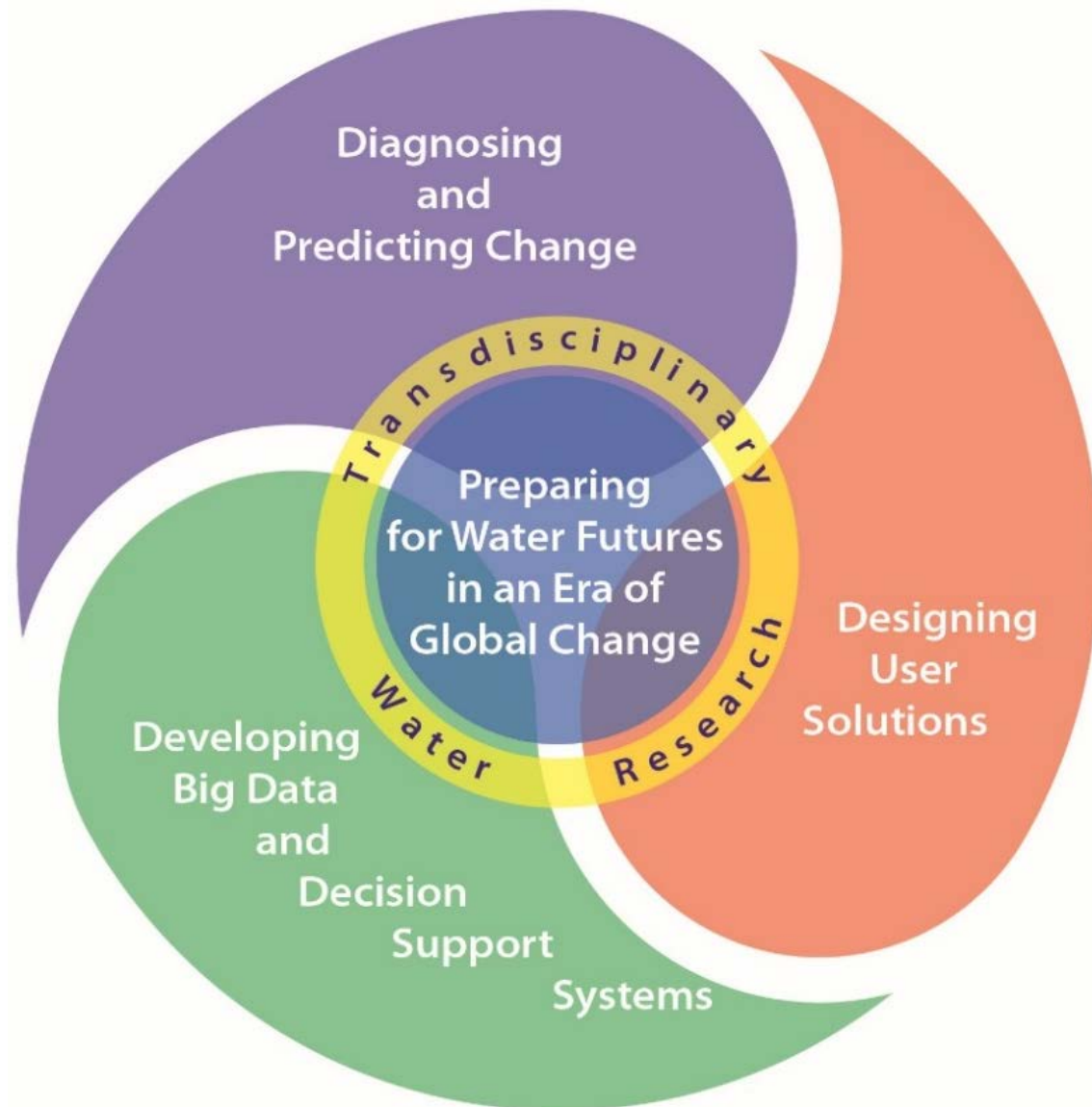
Global Water Futures will position Canada as a:

- Global leader in water science
- Global partner of choice for water research
- Provider to Canada and the world of solutions to water threats



Transdisciplinary Science Pillars

- **Pillar 1** - Diagnosing and Predicting Change in Cold Regions
- **Pillar 2** - Developing Big Data and Decision Support Systems
- **Pillar 3** - Designing User Solutions

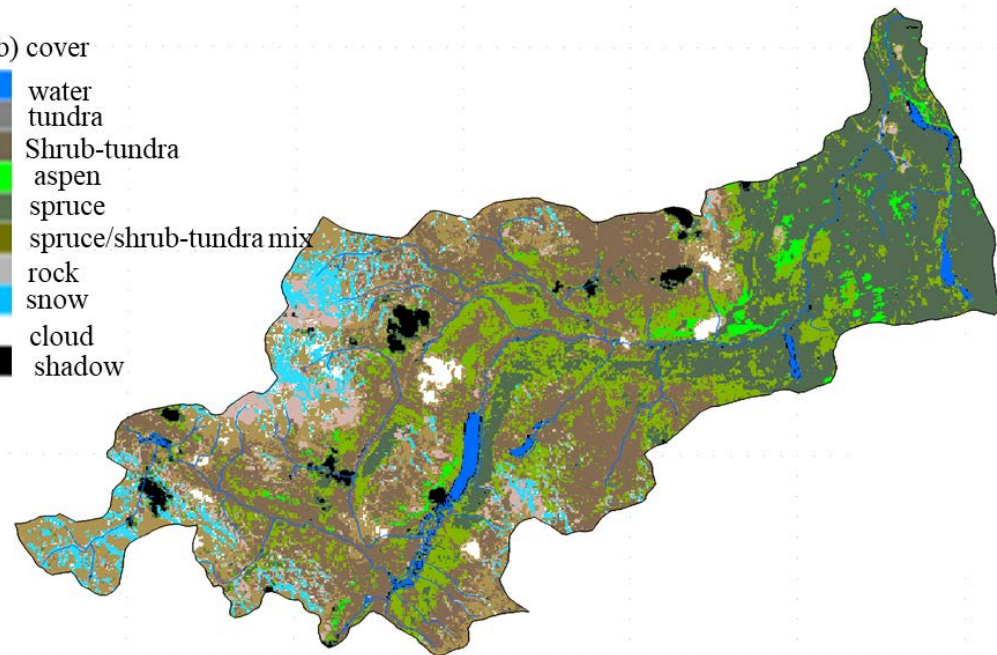
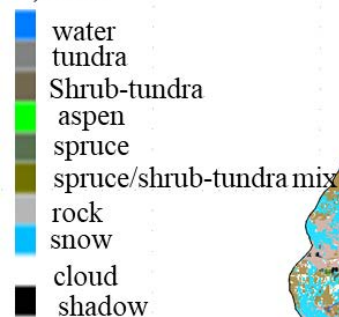


Pillar 1 Diagnosing and Predicting Change

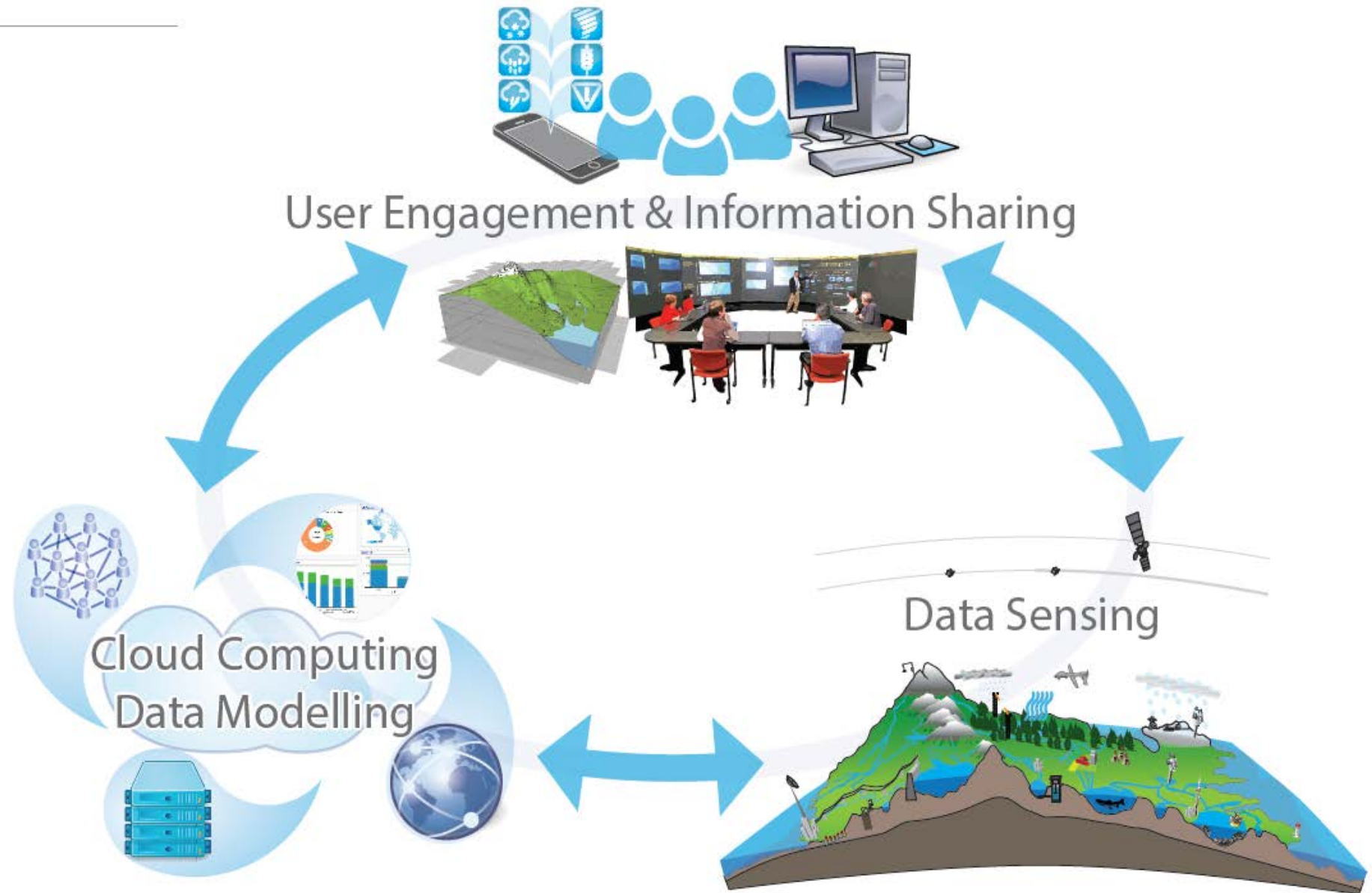
- Hydrometeorology & climate change,
- Hydrology & ecology,
- Water quality & aquatic ecosystems,
- Human-water systems,
- Water & health



b) cover



Pillar 2: Big Data for Canada's Water





Pillar 3 – Designing User Solutions

- Provide tools and solutions that Canada and similar cold regions currently lack to manage the water environment in the face of unprecedented change
- Develop the data access, models and new visualization and interactive decision-making systems to predict and manage risk
- Launch a new era of public water warning and information through apps and social media
- Open a new era of water-related public engagement, drawing on social media with apps that engage and inform the public, crowd-source data and provide place-based real-time information

- \$77.8 million grant from *Canada First Research Excellence Fund* 2016-2023
- GWF has funded 33 Projects
 - 15 universities across Canada
 - 152 university faculty investigators
 - 481 Researchers hired over the first three years
 - graduate students, post-doctoral fellows, scientists, engineers, technicians, and managers
 - 210 partners -- federal & provincial government agencies, First Nations, industry groups, international institutions, NGOs, and communities
- GWF supports three global programmes
 - UNESCO, World Climate Research Programme, Future Earth
- \$185 million in GWF project and core team funding for first three years
 - \$ 23.5M GWF cash grant awarded to projects
 - \$ 14.6 M GWF funding to operate core teams
 - \$26.8M leveraged by projects (cash)
 - \$119.7M leveraged (in-kind support)

The Details



- 21 transformative research, big data and decision support tool projects approved for Pillars 1 & 2
 - Atmospheric Science, Hydrology, Water Quality, Water Management & Governance, Health
 - Sensors, crowdsourcing, computing
- 12 user-question led projects funded for Pillar 3
 - Regional – e.g. Great Lakes, North, Prairies, Mountains, Boreal
 - Sectoral – e.g. Agriculture, Mining
 - Topical – e.g. First Nations co-development, modelling & prediction, algae, climate extremes
- 6 Core Teams Established
 - 36 core modellers
 - 7 computer scientists
 - 20 observatory technicians (Yukon, NWT, Rockies, Saskatchewan, Ontario)
 - 4 data managers
 - 4 knowledge mobilisation specialists including First Nation member specialist
 - 9 communications specialists
- Observatories Staffed, Predictions Started
 - \$90M in federal budget for National Hydrological Service for enhanced water observations and national water prediction system – .
 - Flood forecasting system implemented for Yukon Territory
 - Mountain snow forecasting system for Bow River headwaters in Canadian Rockies
 - Mackenzie, Saskatchewan river basins modelled for current and future climates
 - Smart Water Systems Laboratory (Western Economic Diversification, CFI)



GWF Young Professionals Program

- To bring together all new researchers (graduate students and postdoctoral fellows) from the national and international partnering institutions under the GWF program.
- The overall objectives of the GWF-YP program to:
 - provide a sense of community amongst new researchers with GWF;
 - provide resources for mentoring amongst the GWF-YP;
 - enable collaboration and networking, both nationally and internationally;
 - offer professional development courses and activities.
- ***Eligibility***
 - All graduate students and postdoctoral fellows under the GWF program are eligible to become members and run for GWF-YP executive roles.





GWF Young Professionals

- President – Holly Annand
- Waterloo Chapter Chair – Samina Hayat
- McMaster Chapter Chair – Erin Nicholls
- Laurier Chapter Chair – Cory Wallace
- CYHS
 - Chair – Nadine Shatilla
 - Co-Chair – Kelly Biagi



GWF and Indigenous Community Water

- GWF is committed to collaborating with Indigenous communities to find solutions to water problems identified by the Indigenous communities.
- We want to provide GWF resources to co-develop research partnerships that can find solutions to water problems
- Research proposals should be evaluated using a co-developed approach and with advice and review by Indigenous people
- We can do things differently and show Canada how to better conduct research.



GWF Indigenous Community Water Research Strategy

- The GWF Indigenous Community Water Research Strategy is informed by ongoing discussions in ON, YT, AB, NWT, MB and SK over 2017 & 2018, and the Inception Meeting Café discussions on Indigenous Communities (Waterloo, Jan 2018).
- The strategy comprises three components
 - Ongoing discussion and engagement between GWF and indigenous communities through regional workshops and discussions.
 - Project and core team engagement with Indigenous communities
 - A Request for Proposals focused on *GWF Indigenous Community Water Research*. An April workshop at Wanuskewin brought together Indigenous community representatives and GWF researchers to scope out and co-create potential projects and begin to frame draft proposals.
 - There is up to \$2M available for this Request for Proposals.



GWF Indigenous Communities Related Funded Projects - Underway

- Co-creating of Indigenous Water Quality Tools, Dawn Martin-Hill, McMaster University
- Collaborative Modelling Framework for Water Futures and Holistic Human Health Effects, Lalita Bharadwaj, University of Saskatchewan
- Adaptation Governance and Policy Changes in Relation to a Changing Moisture Regime Across the Southern Boreal Forest, Colin Laroque, University of Saskatchewan
- Northern Water Futures, Jennifer Baltzer, Wilfrid Laurier University
- Prairie Water, Chris Spence and Colin Whitfield, University of Saskatchewan
- Sensors and Sensing Systems for Water Quality Monitoring, Ravi Selvaganapathy, McMaster University



GWF “International”

- INARCH – mountain hydrometeorology and hydrology
- GEWEX –
 - applying as a Regional Hydroclimate Project
 - Water for the Food Baskets of the World
- UN Water Action Decade
 - Work with UN University
 - Strategy and Action Plan - Outreach
- Future Earth – Water Futures
- MESH Modelling – Iran, India, Israel
- Third Pole Environment Exchanges – Chinese Academy of Sciences
- Interest
 - Upper Nile, Indus, Andes, Kazakhstan



WATER
ACTION DECADE
2018-2028





GWF Inception Meeting, Waterloo, Jan 2018

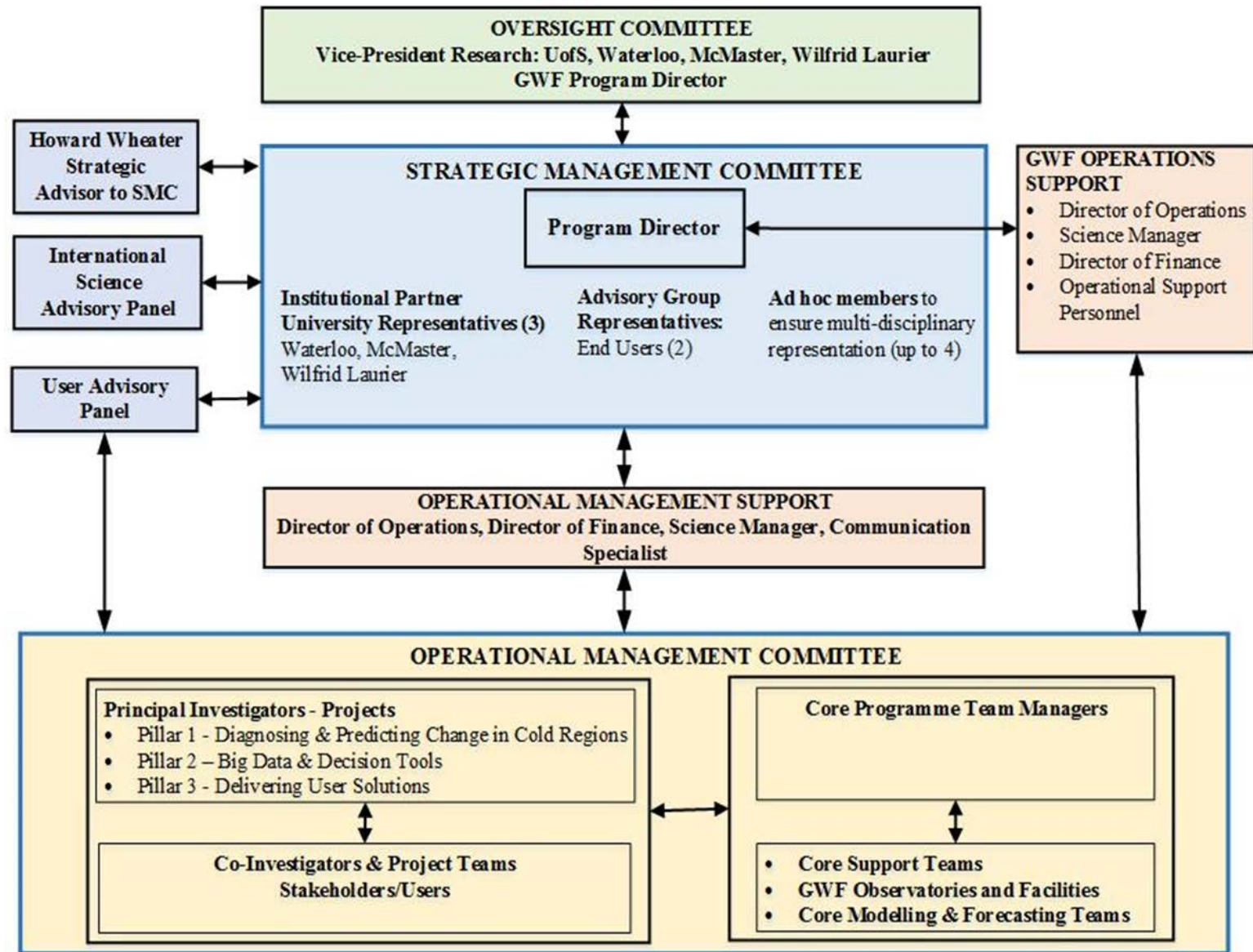


GWF Inception Statement



- GWF has identified a *Grand Challenge*: **how can we best prepare for and manage water futures in the face of dramatically increasing risks from a changing climate, developing economy and changing society?**
- GWF is engaging with all levels of government across Canada, with special interest in engagement with Indigenous communities and international UN-based science organisations.

Global Water Futures Governance & Organizational Structure





GWF Strategic Management Committee

- Program Director – **John Pomeroy**, UofS
- University of Waterloo lead – **Philippe van Cappellen**
- Wilfrid Laurier University lead – **Jennifer Baltzer**
- McMaster University lead – **Sean Carey**
- Socio-hydrology – **Patricia Gober**, UofS
- Water Environment – **Helen Baulch**, UofS
- Climate and Atmospheric Science – **Ronald Stewart**, University of Manitoba
- Big Data, Urban Communities, and Groundwater – **David Rudolph**, University of Waterloo
- Water Resources Management, Communities – **Lawrence Martz**, UofS
- Stakeholders/Users, Government, Measurements, Modelling and Forecasting – **Alain Pietroniro**, Environment and Climate Change Canada



GWF Advisory

- Strategic Advisors to the SMC
 - Howard Wheeler
 - Merrel-Anne Phare
- International Science Advisory Panel
 - Anthony Jakeman, Australian National University, Australia
 - Blanca Jimenez Cisneros, Director of the Division of Water Science, UNESCO, Paris
 - Eric Kasischke, University of Maryland, USA
 - Dennis Lettenmaier, University of California at Los Angeles, USA
 - Xin Li, Director of Laboratory of Remote Sensing and Geospatial Science, CAREERI/Chinese Academy of Sciences
 - Claudia Pahl-Wostl, University of Osnabrück, Germany
 - Roy Rasmussen, National Center for Atmospheric Research, USA
- User Advisory Panels
 - Indigenous



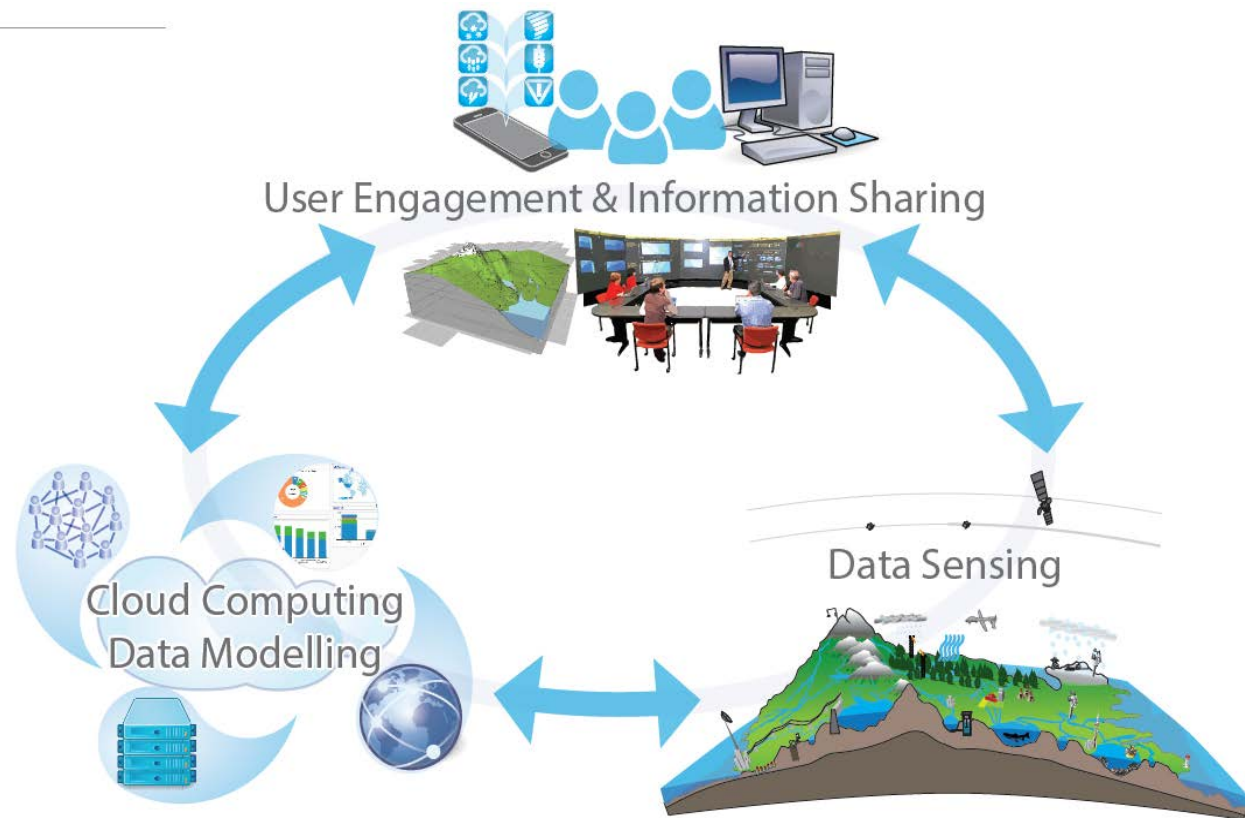
GWF Secretariat

- Phani Adapa, Director of Operations
- Chris DeBeer, Science Manager
- Kelly McShane, Director of Finance
- Viet Truong, Financial Officer
- Stacey Dumanski, Outreach Coordinator
- Mark Ferguson, Communications Specialist
- Branko Zdravkovic, Data and IT Manager
- Michelle Martel-Andre, Human Resources and Facilities, UofS
- Sherry Olauson, Clerical Assistant Finance, UofS

GWF National Water Observation and Prediction Strategy

- **Core support teams to deliver national modelling capability, advanced computer science, new observational science and knowledge mobilization**
- **User-question led project-focussed funding**

- **Technical Team (20):**
Observatories & Observations
- **Data Management (4)**
- **Computer Science (7) –**
Human Computer Interface,
Data & Re-engineering Codes
- **Modelling Core Team (36)**
 - Hydrological & Water Quality Forecasting
 - Climate Change, Diagnostic Hydrological & Water Quality Modeling
 - Water Resources Modelling
- **Knowledge Mobilization (4)**
- **Communications (9)**



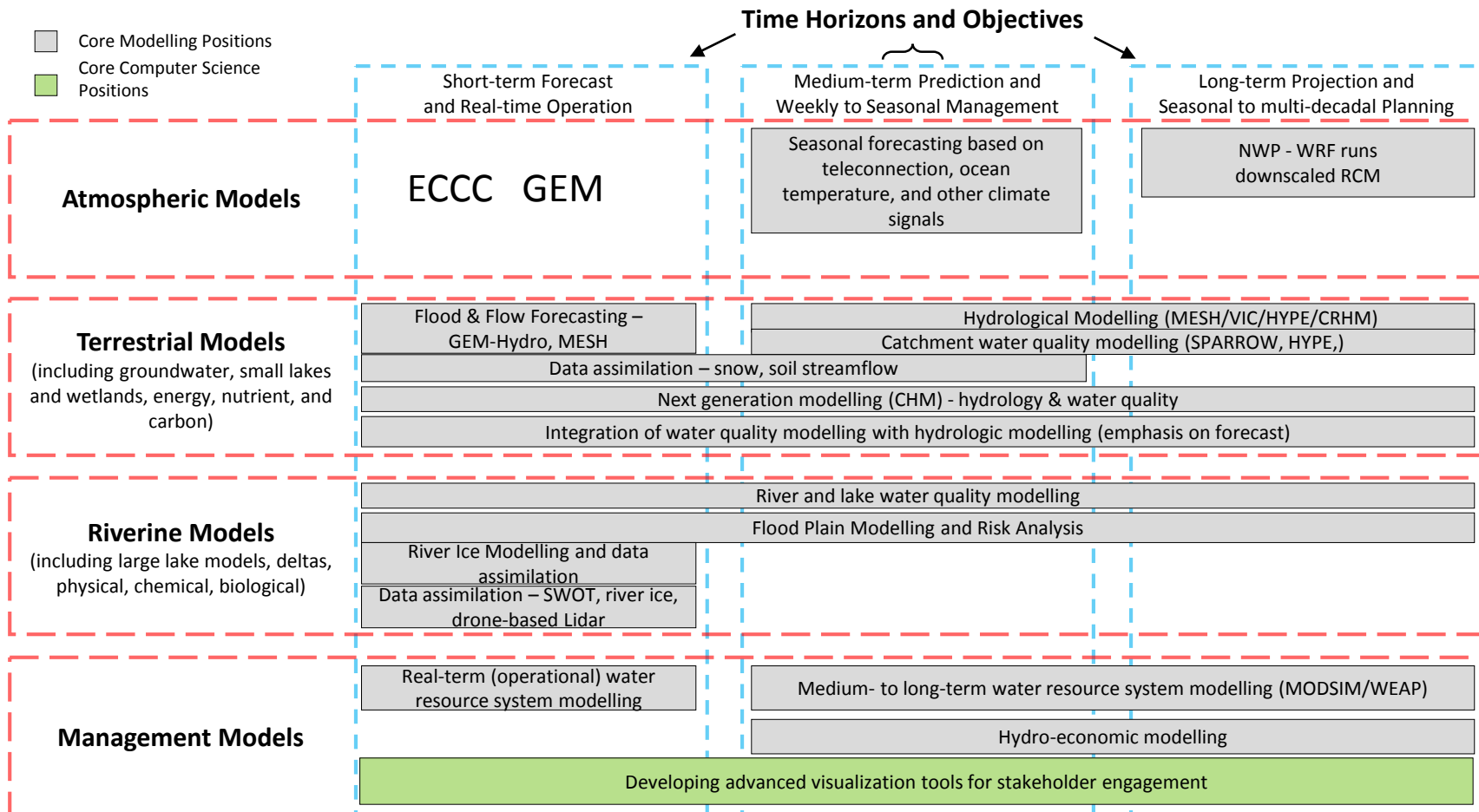


Smart Water Systems Laboratory





GWF National Integrated Modelling Strategy



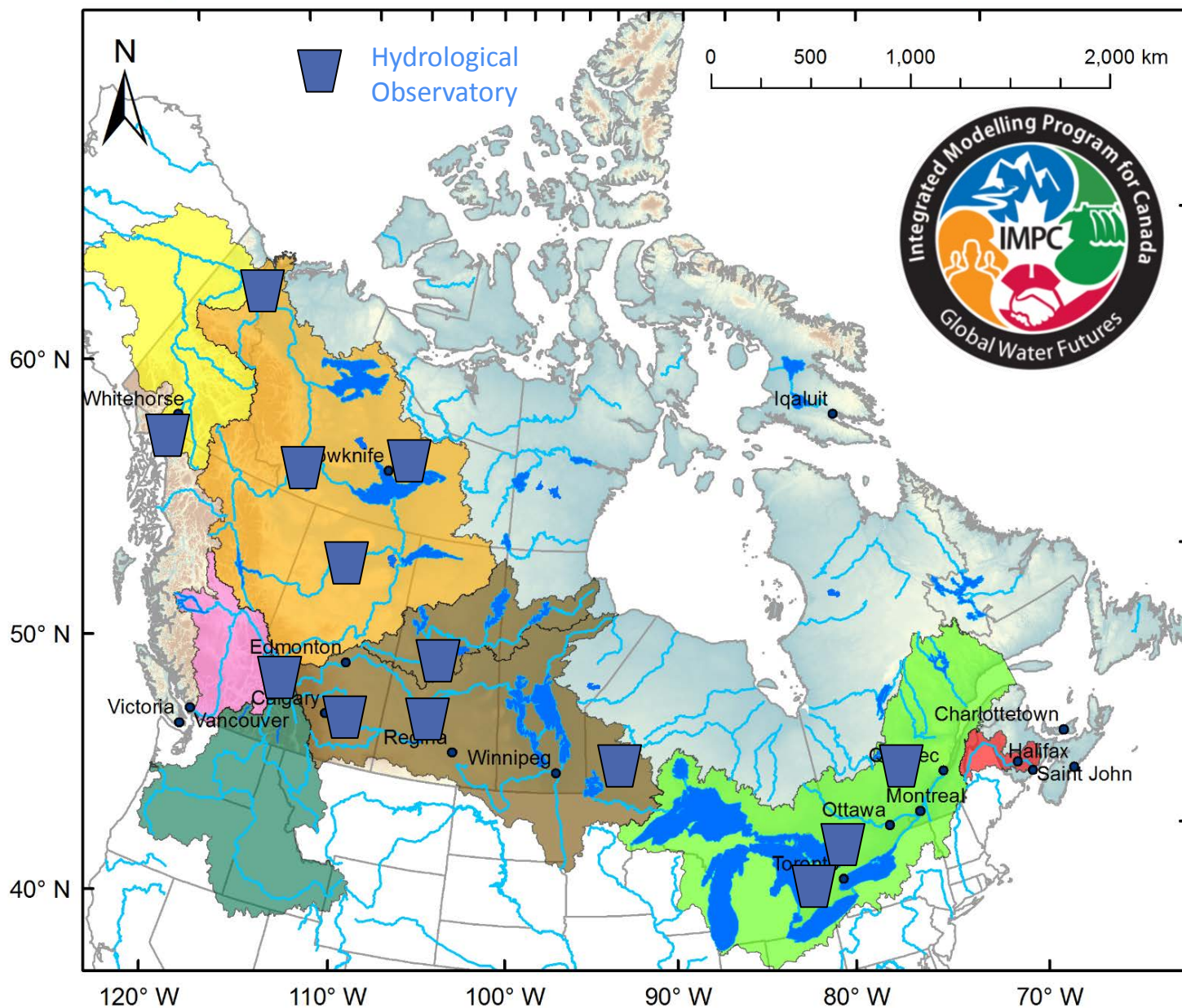
GWF National Water Prediction Strategy



UNIVERSITY OF SASKATCHEWAN
Global Water Futures
GWF.USASK.CA



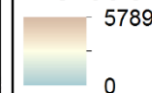
170° W 150° W 120° W 90° W 60° W 40° W 30° W 20° W



Global Water Futures Integrated Modelling Programme

- Saint John
- Great Lake-St Lawrence
- Nelson-Churchil
- Mackenzie
- Yukon
- Fraser
- Columbia
- Major City
- River
- Lake

Elevation (m)



Model Area ~ 5 M km²
Approximate size of EU



UNIVERSITY OF SASKATCHEWAN

Global Water Futures

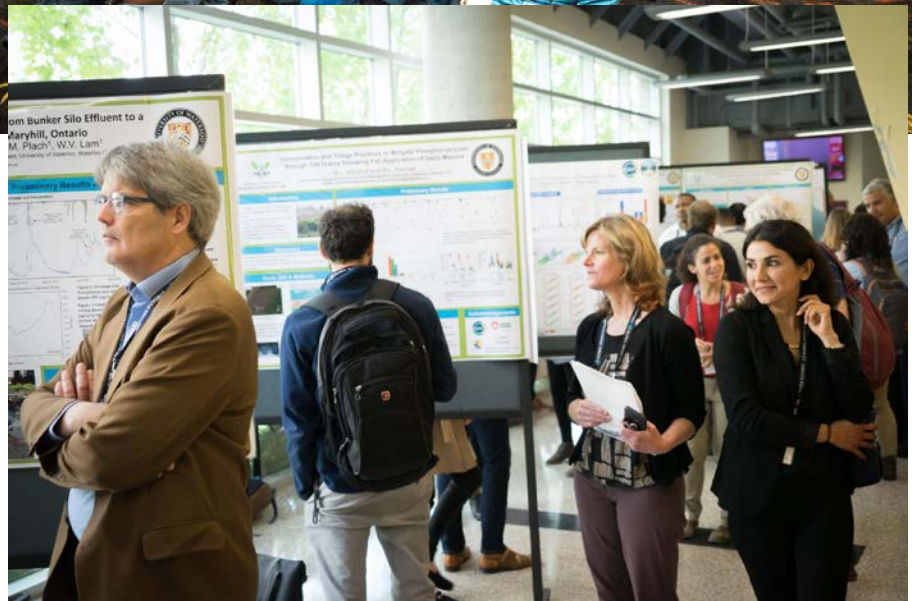
GWF.USASK.CA



GWF Inaugural Meeting Wrap-up



- 4 remarkable days in June, hosted by McMaster and Six Nations – *thank you!*
- Our comprehensive water conference brought together the broader Canadian water community like never before
 - +400 people from across Canada, and from UN, WCRP, Future Earth.
 - 160 presentations from academics, students, researchers, Indigenous knowledge holders, policy makers, managers, communicators,



GWF Grand Challenge – Sept. 2017



UNIVERSITY OF SASKATCHEWAN
Global Water Futures
GWF.USASK.CA



- GWF has identified a *Grand Challenge*: **how can we best prepare for and manage water futures in the face of dramatically increasing risks from a changing climate, developing economy and changing society?**





GWF Inception Statement – Jan 2018

- GWF has initiated 33 projects addressing critical water research needs, big data and decision support tool development, sensors and user-questions, and 6 core teams addressing observations, data, prediction, computing, knowledge mobilization and communications.
- Projects and teams have exchanged best practices, begun their activities and are engaging with over 170 partners/users whilst training over 440 HQP.
- GWF is engaging with government, industry and communities across Canada, with a special interest in engagement with Indigenous communities and international science organisations.





GWF Inaugural Statement

- GWF has met as a whole for the first time and has brought together a large and comprehensive transdisciplinary group of water researchers and stakeholders in water research who discussed progress in meeting the GWF Grand Challenge. This meeting was remarkable for being exceptionally comprehensive in the subjects represented, for the early and rapid progress shown, and for being hosted and co-organized by a First Nation, on its own territory.
- Special attention was paid to progress in
 - international linkages for GWF,
 - regional and topical scientific advances in Canada,
 - co-creation of knowledge with First Nations
 - needs of Young Professionals and
 - integration of research needs and advances in understanding and technology on
 - modelling and observations,
 - aquatic environment and ecosystems,
 - human-water interactions,
 - watershed management and disturbance,
 - climate and extreme weather



Parallel Session Organizers and Chairs

- **Modelling and Observations**
 - Saman Razavi, Dave Rudolph, Ravi Selvaganapathy, Tricia Stadnyk, Claude Duguay
- **Human – Water Interactions**
 - Rob de Loë, Nancy Doubleday, Graham Strickert, Lalita Bharadwaj, Roy Brouwer
- **Watershed Management and Disturbance**
 - Merrin Macrae, Nandita Basu, Brent Wolfe
- **Aquatic Environment and Ecosystems**
 - Helen Baulch, Mark Servos, Patricia Chow-Fraser, Jason Venkiteswaran
- **Climate and Extremes**
 - Ron Stewart, Julie Thériault, Francis Zwiers, Yanping Li



GWF 1st Annual Science Meeting Planning/Organizing Committee

- John Pomeroy, University of Saskatchewan
- Jennifer Baltzer, Wilfrid Laurier University
- Helen Baulch, University of Saskatchewan
- Dawn Martin-Hill, Six Nations & McMaster University
- Chris DeBeer, University of Saskatchewan
- Kelly McShane, University of Saskatchewan
- Stacey Dumanski, University of Saskatchewan
- Sarah Irvine, McMaster University
- Katie Black, McMaster University
- Nadine Shatilla, McMaster University
- Stephanie Morningstar, Six Nations & McMaster University
- Sean Carey, McMaster University
- Krysha Dukacz, McMaster University
- Michelle Martell-Andre, University of Saskatchewan
- Phani Adapa, University of Saskatchewan
- Mark Ferguson, University of Saskatchewan
- Erin Nicholls, McMaster University
- Stephanie Merrill, University of Saskatchewan
- Kelly Biagi, McMaster University
- Joni Onclin, University of Saskatchewan
- + many local student volunteers from McMaster University and community volunteers from Six Nations



UNIVERSITY OF SASKATCHEWAN

Global Water Futures

GWF.USASK.CA





Ric Janowicz. 1952-2018



There is no holding back now....





Global Water Futures

National Hydrology Research Centre

11 Innovation Boulevard

Saskatoon, SK S7N 3H5 Canada

Tel: (306) 966-2021; Fax: (306) 966-1193

Email: gwf.project@usask.ca

Website: www.globalwaterfutures.ca