

# Climate Change Guidance Framework 2024 Report



International Joint Commission  
December 2024

*Hamilton, ON (photo credit: M. Kain)*



(Above) Lake in South Ontario

## Preamble

In April 2016, as part of its ongoing International Watersheds Initiative (IWI), the International Joint Commission (IJC) organized a workshop at which its boards identified the need for a framework to help them prepare for climate change. In response, the IJC worked with the boards to develop a general framework including a recommended planning guidance method that could be used by IJC control boards, pilot-watershed and watershed boards, and accredited officers. That guidance, known as the Climate Change Guidance Framework (CCGF), is a critical part of IJC and board activities. Following reports in 2018 and 2021, this third report details progress made under the framework and remaining challenges.

## Acknowledgements

The IJC wishes to acknowledge the support of the following individuals. Their contributions were critical to the completion of this report. This report was developed by a team with Dave Dempsey as the lead drafter. The report benefited from input and review by Catherine Lee-Johnston (IJC-Ottawa), Adam Greeley (IJC-Washington), Jo Werba (IJC-Washington), Celine Desjardins (IJC-Ottawa), Mark Colosimo (IJC-Washington), Glenn Benoy (IJC-Ottawa), Rob Caldwell (IJC-Ottawa), John Allis (IJC-Washington), Avni Solanki (IJC-Washington), Lyne Sabourin (IJC-Ottawa), Erika Klyszejko (IJC-Ottawa), Mark Gabriel (IJC-Washington), Kevin Bunch (IJC-Washington), Chrissy Chiasson (IJC-Ottawa), and Yon Trimble (IJC-Washington).

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## Overview

The water cycle – evaporation, condensation, and precipitation – is closely intertwined with the role of the IJC in helping prevent and resolve disputes between Canada and the U.S. over use of the boundary waters. As climate change alters the water cycle, it also alters the ways in which the IJC and its transboundary boards assess, prepare for, and build resiliency in response to the new realities of precipitation, temperature, and corresponding flows.

Canadian IJC Chair Pierre Baril noted the significance of the issue to the IJC noting that “Climate change has already begun to impact the Commission’s work in a number of ways, including more extreme weather events and the timing and frequency of hydrologic events. We need to ensure our boards are better prepared to react, address and communicate these impacts.” The IJC can best serve Canada and the U.S. under the Boundary Waters Treaty of 1909 if a changing climate and its effect on boundary waters are taken into account.

Evidence of a changing climate spans the entire Canada-U.S. boundary. Record flooding and drought, significant and swift fluctuations in precipitation and river flows are challenging communities in boundary watersheds. In addition, the seasonal span of ice formation and the volume and timing of spring freshets are increasingly difficult to predict.

To strengthen its ability to respond to these unprecedented events and conditions, the IJC developed a Climate Change Guidance Framework (CCGF, or ‘framework’) in 2017. This IJC initiative was built on the premise that IJC control, watershed, and pilot watershed boards could learn from each other and apply lessons learned as they plan for the future of their watersheds. The CCGF provides a way for IJC boards to document and share information as they assess their vulnerabilities to climate change impacts and ways to adapt and build resiliency in the future.

United States IJC Chair Gerald Acker said “Climate change is a massive challenge that poses a fundamental threat to both the United States and Canada. These now catastrophic events have required collaboration between the IJC and its boards along with other agencies, organizations, Indigenous communities. This has been part of the IJC’s success for more than a century, and this support will help ensure a more resilient future between our nations.”

The CCGF lays out a four-step process for boards to determine how each one’s unique responsibilities may be affected. These steps are **organize, analyze, act** and **update**.

- **Organizing** means each board formulates its climate-related objectives and assesses the information needed to determine whether its duties could be impacted.
- **Analyzing** involves gathering information and reviewing it to answer those questions
- **Acting** adjusts how a board will fulfill its obligations going forward.
- **Updating** means refreshing climate change assessments periodically as more information and new conditions emerge.

An immediate use of the CCGF was to determine whether existing IJC Orders of Approval or Regulation Plans were resilient to climate change. In other words, would shifting ranges of variation due to climate change, beyond existing ranges of variation observed in water levels and flows,

compromise the ability of Orders or Regulation Plans in place to meet their objectives? Were those objectives still relevant in the face of the climate emergency? Similar determinations could also be made about apportionments and other board responsibilities.

The International St. Croix River Watershed Board was the pilot for the framework process in 2018. The board found that the impacts of climate change will likely result in more frequent low water flows in the watershed, which may require amendments to existing water management guidelines to continue meeting water flow requirements established by governments.

The framework’s principles have been used as part of large studies across transboundary. In 2022, the International Lake Champlain-Richelieu River Study Board completed an examination of flood risks and mitigation. CCGF principles helped shape the Great Lakes-St. Lawrence River Adaptive Management Committee’s (GLAM) work as part of its expedited review of the regulation plan for Lake Ontario-St. Lawrence River system, Plan 2014, including assessing the robustness of the regulation plan to climate change impacts and also aligns with the Committee’s approach use of



Hamilton, ON (photo credit: M. Kain)

adaptive management to support the Great Lakes control boards. In the St. Mary and Milk River basin, the CCGF process has informed ongoing climate change assessment work. A working group of the International St. Mary and Milk River study team completed a State of Knowledge Report on Climate and Hydrology of the St. Mary and Milk River Basins in December 2022. The report found that the hydrological monitoring of both basins is scarce, and that an important task will be to identify suitable global climate models and downscale and bias correct. The Technical Working Groups are developing hydrologic models and methods to simulate streamflow using future climate inputs. The Climate and Hydrology Technical Working Group will use data (and models) that are readily available and open-source, and will consider a variety of data including climate, naturalized stream flows, land cover, land use and other datasets needed to model the hydrology of the St. Mary and Milk River watersheds.

The boards are in different stages of applying the CCGF to their work, but all are progressing in following its guidance. Continuing progress will best occur if this report and other centralized information and data facilitate interaction among the boards. This 2024 Highlights Report, then, is part of a broader coordination effort, and identifies and surveys recent and continuing activities and progress covering the period of 2022-2024.

## CCGF Activity Across the Transboundary Since the 2021 Highlights Report

### St. Croix River

The impact of changes in climate has been felt keenly in the St. Croix River watershed. An official drought designation in some parts of the watershed has occurred almost every year over the last decade. Several of these were “flash droughts”, brought on by a lack of precipitation and above normal air temperatures.

The pattern of low water supplies is consistent with the board’s 2018 pilot CCGF assessment. Given the frequency and severity with which this has occurred, the board is more intensely studying how to address the negative impacts of low water flows through its water management requirements study, funded through the IWI. The purpose of the project is to provide a present-day understanding of the complexities of water management in the International St. Croix River Watershed by creating a compilation of existing water management requirements affecting water levels and flows in the watershed that may impact compliance with requirements of the IJC Orders of Approvals. This project is designed to compile information on current federal, state/provincial, and local water license and permit conditions and requirements for physical and chemical water quality, water flow, and seeking to determine whether it is possible for water managers to meet all requirements associated with permits, licenses and other commitments during these periods of drought, when natural runoff is scarce. A watershed model will follow, using these water management requirements as inputs/ variables. Ultimately, the board would like to inform answers on watershed management during these more frequent drought periods and provide information for those involved in the development of these requirements.

### Rainy-Lake of the Woods

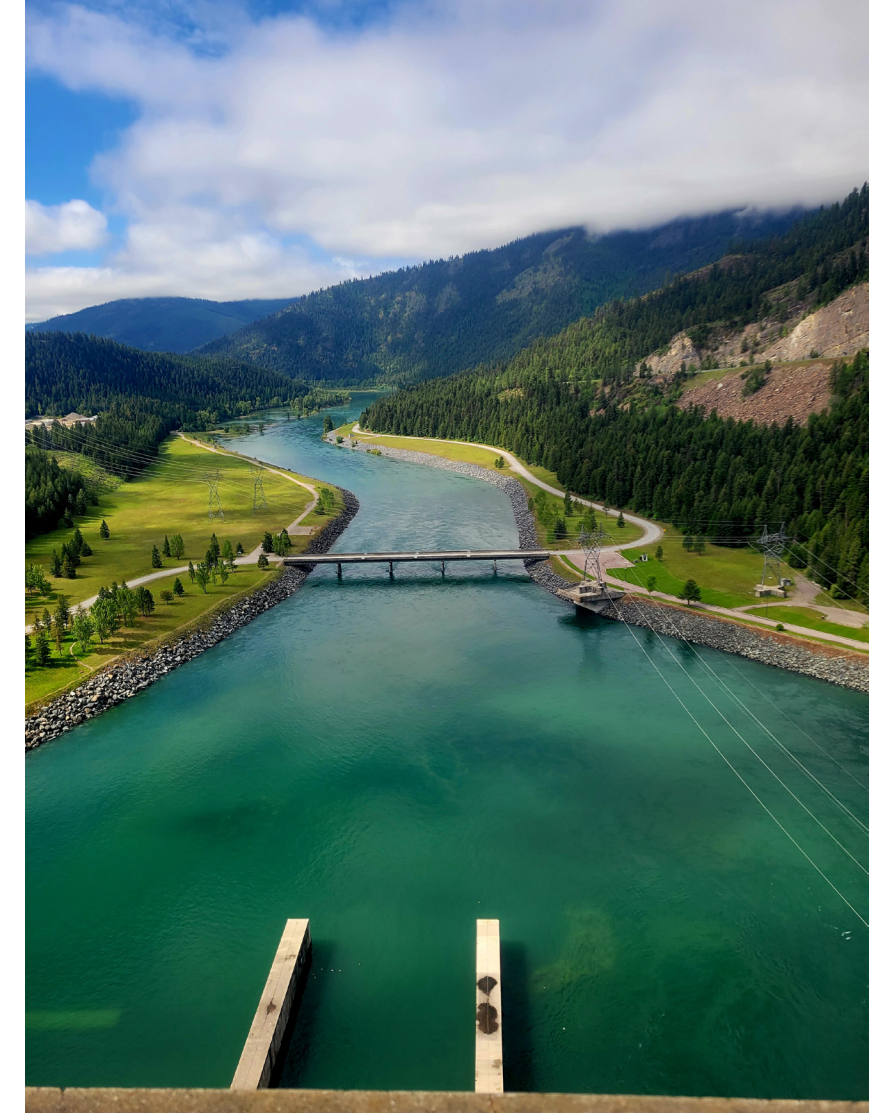
The past several years have been pivotal for cementing the seriousness and unpredictability of a changing and variable climate for the Rainy – Lake of the Woods basin. From severe drought in 2021, to catastrophic flooding that erupted over just a couple of weeks in spring 2022 following intense, back-to-back precipitation events, and back to extraordinary drought in 2023, the basin has experienced the whiplash of increasing climate variability.

Though no attribution studies have yet been done on most specific extreme weather events in the Rainy – Lake of the Woods basin, we know that as the atmosphere warms, it is able to hold more water vapor and thus has the potential to deliver exponentially more rainfall in a single event than would have been the norm in the cooler past. Climate change likely exacerbated the magnitude of extreme snowfall and rainfall events in the spring of 2022, just as it likely drove the record heat experienced in the region in early June 2021.

In the Rainy – Lake of the Woods watershed, the International Rainy -Lake of the Woods Watershed Board’s (IRLWWB) Adaptive Management Committee (AMC) is leading implementation of the Climate Change Guidance Framework, given the congruence between the CCGF’s adaptive management methodologies and the mandate and function of this committee.

The AMC is not alone in focusing on climate change impacts in the basin. Given the watershed board’s broader mandate also to address issues relating to water quality and aquatic ecosystem health, the AMC is also increasingly collaborating with the board’s Aquatic Ecosystem Health Committee (AEHC) and the Community and Industry Advisory Groups (CAG, IAG) to develop approaches for implementing adaptive management regimes for addressing climate change impacts and adaptations across the basin. Meanwhile, other IJC committees, groups, and past study boards also have contributed to growing the body of knowledge about climate change impacts to the basin.

Even before the IJC’s Climate Change Guidance Framework was developed, resource managers in the Rainy – Lake of the Woods basin were documenting and studying climate



Libby Dam (photo credit: R. Caldwell)



(Above) Rainy Lake of the Woods

change impacts on water levels, water quality, and aquatic ecosystem health, including the 2014 State of the Basin Report, the 2015-2018 Rule Curve Study, the 2015 Water Quality Plan of Study, the 2022 State of the Basin Report, and a 2022 Climate Change workshop. The AMC is implementing several recommendations from its 2022 Climate Change Workshop Report through a spate of new projects.

A major recommendation from the 2022 Climate Change Workshop Report is to convert the models used in the 2015 Rule Curve study into a modernized, more powerful, user-friendly, open-source Integrated Social, Economic and Environmental (ISEE) model that is better able to quickly calculate potential flood impacts and costs related to regulatory decisions and / or climate impacts.

In 2023, the AMC began a major project with the Environment and Climate Change Canada (ECCC) modelling team that developed the 2015 Rule

Curve Integrated Ecosystem Response Models (IERM). A valuable tool in its own right, IERM has been enhanced by ISEE, which is computationally faster and built on open-source code, whereas IERM was built on a proprietary platform. The open-source code means that anyone with knowledge of the model can use the ISEE system. Perhaps of greatest value for climate communications, ISEE can generate outputs that can be visualized as 3-D landscape renderings of flood effects on streetscapes, shorelines, and floodplains throughout the transboundary.

Meanwhile, the AMC also launched the first of three anticipated Indigenous engagement projects that are also intended to inform the updates and revisions to the ISEE system, and the future regulation of water levels in the basin:

- Grand Council Treaty #3 has been contracted to work primarily with the Anishinaabe Nation in Treaty 3, with opportunities for Tribes and First Nations in the basin to participate, in knowledge sharing sessions aimed at learning and better embedding Indigenous values and vision related to water in all water management decisions and recommendations made by the IRLWWB and its committees.

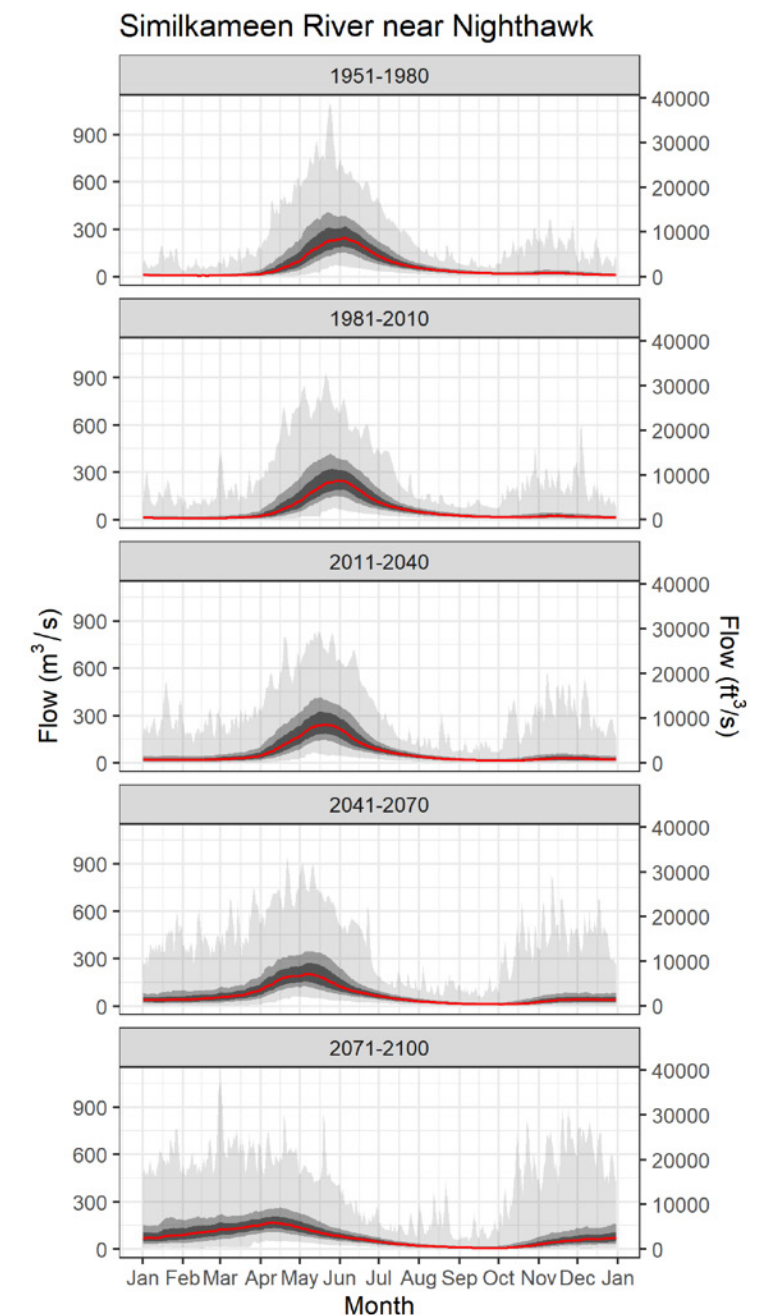
- A second Indigenous engagement project to work directing with the Northwestern Ontario Métis Council was submitted for consideration in September 2023, and discussion is underway with Minnesota Tribes in the basin to develop appropriate engagement strategies or projects in 2024.
- The AMC hopes Indigenous technicians can be trained to operate the completed ISEE model as one of the outcomes that could emerge from pairing these projects on a parallel timeline.

The IRLWWB August 2022 Climate Change Workshop served the CCGF function of Organizing (Step 1) collective thinking about climate change risks and threats. The workshop report provided recommended actions for Analysis (Step 2), including suggested data gathering, monitoring, and modelling tools the board might need to make well-informed management decisions in future. In 2023, the IRLWWB launched an array of AMC projects that will provide tools to help operators to better understand impacts of regulatory decisions, under the Analysis and subsequent Action (Step 3) phases of the CCGF.

#### International Osoyoos Lake Board of Control

Since 2021, the International Osoyoos Lake Board of Control (IOLBC) has conducted substantial climate change modeling and climate outreach to the public and Indigenous communities.

A dramatic water year in 2021 illustrated the potential for hydrological disruption due to climate change. A brutal heat dome in late July with record-breaking temperatures coupled with dry conditions that contributed to record wildfires in the Osoyoos Lake and broader Okanagan basins. Then in November, an atmospheric river caused the Similkameen River discharge to spike (breaking records for a fall event), promoting huge flood damage to communities along the river, and causing the Okanogan River to flow



Osoyoos Lake Climate Change Vulnerability Assessment - Phase 1 - Similkameen Hydrology Graph. Projected changes in hydrologic regime for the Similkameen River near Nighthawk, WA. Red line represents median flow for the period, grey bands represent 25th – 75th percentile, 10th-90th percentile, and maximum/minimum, respectively according to shade. Reproduced from Northwest Hydraulic Consultants Ltd. (2021). Similkameen Basin Hydrologic Model Final Report: Osoyoos Lake Climate Change Vulnerability Assessment (Phase 1). Retrieved from [Osoyoos Lake Climate Change Vulnerability: Phase 1 - Similkameen Basin Hydrologic Model | International Joint Commission](#)

backwards into Osoyoos Lake. While beyond the board’s ability to control, these events emphasized the need for continued work on better understanding the impacts of climate change (including extreme weather events).

The IOLBC has continued work related to merging the Okanagan and Similkameen hydrology models. Phase II of the work, assessing the vulnerability of Osoyoos Lake to a projected shift in the climate and hydrology of the Okanagan and Similkameen Basin, is underway. The objectives of Phase II are:

- Estimate historic and future lake levels for Osoyoos lake
- Analyze potential changes in frequency and timing of future Osoyoos Lake water levels from past hydrologic conditions and the current IJC Orders
- Analyze the changes to frequency to meeting the drought criteria

In preparation for this work and taking advantage of a project managed by the Okanagan Basin Water Board (OBWB), the IOLBC used IWI funds to extend a topo bathymetric LiDAR survey of the Canadian portion of Osoyoos Lake to include the US portion of Osoyoos Lake and portions of the Okanogan River and lower Similkameen River, to use for hydraulic modeling. Also contributing to the hydrology modeling project, the OBWB, a local water management organization, supported a side study to identify the appropriate climate models and downscaling methods.

### International Kootenay Lake Board of Control

Two International Kootenay Lake Board of Control (IKLBC) board initiatives have emerged since the 2021 highlights report that address components of the Climate Change Guidance Framework.

The 1938 Order of Approval for Kootenay Lake has been used to manage Kootenay Lake for over 80 years. Many significant changes have occurred during this period, including the construction and operation of two large upstream dams that altered the hydrology and water quality, and the implementation of many actions in the Kootenay River Basin for flood risk management, improving the ecosystem and addressing other considerations.

In 2022, the IKLBC prepared a paper that assembles information to support potential further research and studies, and to inform consideration of whether a review of the 1938 Order may be warranted. The paper identifies climate change impacts that could result in some additional challenges regulating Kootenay Lake in accordance with the 1938 Order and rule curve, including:

- Winter and early spring lake levels may be higher than in the past due to higher stream flows during these periods. If this occurs, it will make it more difficult to regulate the lake in accordance with the 1938 Order to achieve the lake levels specified in the rule curve.

- If stream flows become more extreme and variable in the spring, it will also make it more difficult to implement some provisions of the rule curve used to manage the lake, such as drafting the lake from January 7 through April 1 and determining the commencement of the spring rise.
- Lake levels in the summer may decrease due to lower stream flows and increased evaporation from warmer air temperatures.

The paper identifies information needs for further research and study, including projected meteorological changes, projected hydrologic changes, and the relevance of climate change to Kootenay Lake and the 1938 Order.

In response to the 2022 information paper, the IKLBC is working with climate change experts (government, academics and consultants) to carry out a climate change vulnerability assessment of the current IJC Kootenay Lake Order of Approval. In addition to conforming to the IJC’s Order of Approval, the expert’s assessment plan will include all four steps of the IJC’s Climate Change Guidance Framework. The final report is expected to be delivered by spring 2025. This final report will summarize the development and calibration of Lake Kootenay hydrological reservoir models, an analysis of current and future Kootenay Lake levels and the vulnerabilities of the 1938 Order of Approval to anticipated shifts in hydrology due to climate change.

### International Red River Watershed Board

The Red River basin oscillates between wet decades with spring floods and dry decades of extended droughts. Potential changes in hydrology associated with climate change could affect the magnitude and frequency of extreme flooding and drought events in the basin. The Board is currently working on several projects that will enable its future completion of a full CCGF analysis. The International Red River Watershed Board (IRRWB) is nearing the completion of an IWI project entitled Red River Drought Risk Study. The study model’s future low river flow scenarios to better understand dry hydrologic impacts on ecological conditions and water supply. In conjunction with the International Souris River Board and International Rainy-Lake of the Woods Watershed Board, the Red River Board has a project titled Enabling Rain and Snow Water Sampling for Indigenous Communities – CoCoRaHS Kits. These kits will allow more extensive water sampling in the basin allowing for better understanding of variation in weather and hydrology in the basin.



(Above) )The official CoCoRaHS precipitation gauge set to measure rainfall. (photo credit: ECCC). CoCoRaHS precipitation gauge set to measure rainfall (left) and volunteer measuring snowfall and snowpack depth (right). Image reproduced from *Environment and Climate Change Canada*. (2022). CoCoRaHS Precipitation Network. Retrieved from <https://www.canada.ca/en/environment-climate-change/campaigns/50-years-environmental-action/history-photos/cocorahs-network.html>

## International Souris River Board

The Souris River basin is composed of a prairie “pothole” hydrology, on top of which lies a complex series of water management structures, mainly used for power generation, agriculture and flood control measures. In recent years, the IJC highlighted the need for the United States and Canada to develop bias corrected and downscaled climate scenarios, that did not stop at the borders of the respective countries. The International Souris River Board (ISRB) is advancing two related projects that address climate change issues, including future climate projections, historical climate simulations, and hydrologic model advancement.

One project consisted of developing downscaled, and bias-corrected atmospheric model outputs considering various climate change scenarios. These model outputs can be used for multiple Board applications. Climate model outputs are often biased, and several correcting techniques exist. The basic assumption in most techniques is that the underlying process (or time series) is stationary. Therefore, techniques such as Quantile Delta Mapping (QDM) that consider nonstationary biases, preserving the climate change signal in the bias-corrected simulations, may be more appropriate. However, several issues remain unsolved, for example, non-stationarity in the observation time series is often ignored in most techniques resulting in an inconsistent representation of the corrected process at coarser scales. A key question is which downscaling and bias correction technique (or techniques) is the best for application.

A second more recent project focused on developing inputs and outputs for climate modeling. Through the Global Water Futures program, the University of Alabama, in cooperation with the University of Calgary and the University of Saskatchewan, will develop downscaled precipitation, and maximum and minimum temperature datasets for the basin based on recently updated historical simulation data using a novel downscaling method.

The data produced from both studies will be particularly important for the ISRB Adaptive Management Committee and can hold value for investigations conducted by the ISRB’s Aquatic Ecosystem Health and Water Quality committees.

## Multi-Board Climate Change Workshops

### *October 2023 workshop*

In 2023, the IWI held two workshops coinciding with the 25th Anniversary of the IWI program. These meetings brought together IJC board members and associates to discuss elements of the IWI program and to consider the needs and opportunities of the program for the future. The second workshop was held during the October 2023 Fall Semi-Annual Board Appearances and focused on several recommendations identified during the prior



*Lake Memphremagog (photo credit: C. Desjardins)*

workshop in April 2023, including strengthening the IWI’s support for IJC Board climate change studies. Fifty-one people attended the workshop in person and remotely. Key messages emerging from the event included the need to adapt climate change models and scenarios to local watersheds; the need for a climate change consultant team to aid adaptation of climate models; support for the creation of an IJC climate change hub to support the work of IJC boards; development of a broad-based Steering Committee to create a workplan for designing an IWI climate hub, including identifying funding sources; integration of resilience strategies into work plans; and providing a guidance document or template for International Watershed Boards to support adaptation of climate change models and scenarios to local watersheds.

### *October 2024 workshop*

The IWI hosted a climate change workshop in October 2024 during the Fall Semi-Annual Board Appearances in Ottawa. Over 70 people attended the workshop in person and remotely. Board members, scientists and staff again convened, discussed both successes and challenges in working fulfilling their responsibilities within a changing climate, including the application of the CCGF in transboundary basins, as well as climate change related topics more broadly.

New topics that emerged from discussions at the workshop include:

- Increased awareness among board members of potential climate change impacts and acknowledgement of climate concerns in meetings and public communications.
- The potential for establishing adaptive management committees to monitor impacts of water levels and flows. An example is the Great Lakes-St. Lawrence River Adaptive Management Committee, which is using climate change scenarios to test plans and has produced papers on climate impacts. Boards are leveraging partnerships, building relationships within basins, and connecting with organizations interested in climate change.
- Use and adaptation of climate modeling work to address basin-specific concerns and leveraging local expertise by the boards. Some boards are leveraging IJC study work to collaborate on climate models.

Challenges include the lack of data (especially for lake evaporation), the inability of climate models to produce realistic projections of extreme hydrologic events for use in assessing vulnerabilities in transboundary basins, lack of modeling at appropriate geographic and time scales, and difficulties with binational data sharing and harmonization. Boards face limitations in time, resources, capacity, and funding. Boards would benefit from increased climate change expertise.

Some workshop participants said that translating climate data into actionable information is challenging. Better cross-board coordination was suggested as a means of addressing this and related concerns. There was again support for creating a climate hub to share information, tools, and best practices across boards. Workshop participants expressed a desire for a centralized portal or clearinghouse for data, models and Geographic Information System (GIS) files.

Participants supported the establishment of a climate group to support board efforts in recommending climate scenarios and models. Some supported the creation of a “climate hub committee” with representation from each board. Participants also supported an increased emphasis on improving Indigenous engagement and incorporating traditional knowledge into climate change studies.

## Common Insights

Across the transboundary region, IJC boards have encountered similar opportunities and challenges, and have offered ideas for common takeaways and potential solutions. Implementing those solutions can help improve efficiency in addressing challenges and providing opportunities, provided the IJC effectively capitalizes on economies of scale through deployment of centralized resources that all boards can tap when needed. At the

same time, several boards are much farther along than others in making use of the CCGF, and some would benefit from assistance in moving into a key stage of implementation.

Boards and Section staff have identified the following needs:

- Centralized sources of scientific expertise and information to assist with evaluating climate change scenarios and adaptation and resilience strategies
- Identification of best practices and innovative approaches by some boards that other boards can put to work
- Continued and enhanced communication across boards
- Assistance to boards in effectively communicating the complexities of climate change in a manner tailored to specific watersheds

The CCGF has spurred both discussion and action by IJC boards. In the course of reviewing the evolution of the CCGF in their local watersheds, boards have suggested several needs and IJC staff have refined proposals that could further facilitate the benefits of the framework. The following common insights could provide benefits and assist boards pending available resources and timing.

### Road Map

Some boards are farther along than others in implementing the CCGF. Several are at the organizing and analyzing stages, others in the acting stage in the four-stage CCGF process. For those that are earlier in the process, a task list or road map could be helpful in proceeding. Such a road map, assisting boards early in the process of adapting the CCGF framework to local basin needs, would promote the success of climate change activities.

### Cross-board and IJC collaboration

Boards should be encouraged to collaborate with other boards and the IJC to obtain knowledge, experience, and methods. There are CCGF resources available to boards, but they are not always widely accessible. Cross communication among boards and between boards, and IJC Section staff can help enable sharing and collaboration. Forums for inter-board knowledge sharing, including continuation of multi-board workshops, have proven useful and should continue. In addition to ongoing communication among



(Above) Commissioners Pierre Baril (left) and Gerald Acker (right) welcoming participants to IWI Climate Change Workshop in October, 2024.

boards and with staff, forums dedicated to the CCGF are useful. These forums could help promote and enable cross-board and IJC collaboration.

### Climate hub

This concept was first advanced in IJC's 2017 report, A Climate Change Guidance Framework for IJC Boards: Background and Process. There it was described as a shared information pool. This information pool would promote the facilitation of the exchange of information across boards to support successful planning by sharing scientific and technical knowledge, pilot projects, and lessons learned. In the 2021 CCGF Highlights report, the hub was further defined as a central IJC online space that contains all IJC climate change related work products, accessible not just through a search engine, but also through hyperlinked references in summary reports. Building on this concept in the coming years by deploying a hub would strengthen the implementation of CCGF.

### Climate change committee

Creation of a cross-board climate change committee with membership drawn from each board may be helpful in benefiting all boards in knowledge transfer, clarifying roles by having a 'point person' on each board for climate change activities.

### Resilience

Climate change resilience is the ability to prepare for, respond to, and anticipate climate-related events, trends, and disturbances. It involves assessing how climate change will impact watershed hydrology and taking steps to better cope with those risks. Boards will need increased assistance in promoting climate resilience by developing basin wide goals, adopting accountable and transparent performance metrics, and working to achieve them with Indigenous Nations local, regional, state, and provincial governments and other stakeholders. This will call for increased guidance and assistance from IJC in the development of resilience strategies.

## Conclusion

Climate change will have profound implications for stewardship of the Canada-U.S. boundary waters. Viewing such implications through the lens of the CCGF, the IJC and its boards will be better able to mitigate or prevent harm and build resilience. The CCGF will become an ever more important tool for IJC's work.

## Glossary

**Adaptive management** - An iterative process where management changes based on new results and evidence to reduce uncertainty in the system over time. In this way a system can be both managed to the best of current knowledge and managers and researchers can continue to learn about the system.

**AMC - Adaptive Management Committee.** A committee directed to undertake the monitoring, modeling and assessment needed to support ongoing evaluation of the regulation of water levels and flows.

**Atmospheric river** - Atmospheric rivers are relatively long, narrow regions in the atmosphere – like rivers in the sky – that transport most of the water vapor outside of the tropics.

**Climate Scenario(s)** - A climate scenario is a plausible representation of future climate that has been constructed for explicit use in investigating the potential impacts of anthropogenic climate change. Climate scenarios often make use of climate projections (descriptions of the modelled response of the climate system to scenarios of greenhouse gas and aerosol concentrations), by manipulating model outputs and combining them with observed climate data.

**CoCoRaHS - CoCoRaHS Canada (Community Collaborative Rain Hail and Snow)** - volunteer network of mostly citizens and organizations (e.g. watershed groups, conservation authorities, agriculture organizations, etc.) that measure and report precipitation daily.

**Control board** - An IJC board that is primarily mandated with responsibilities regarding the levels and flows of transboundary and boundary waters.

**Data harmonization** - A collaborative effort to integrate Canadian and U.S. geospatial data to produce a suite of seamless hydrographic data products.

**Downscale** - Applying global climatological predictions locally to adjust historical streamflow, or other hydrological data, up or down.

**Drought criteria for the Osoyoos Lake Board of Control** - Criteria used to determine whether or not a drought is declared, each having a 20-25% probability of triggering a drought in any given year.

**IERM - Integrated Ecosystem Response Model.** Establishes the framework for evaluating, comparing, and integrating the responses for the environmental performance indicators.

**ISEE - Integrated Social-Economical-Environmental** (ISEE) modelling platform that incorporates performance indicators for evaluation of scenario impacts.

**Orders of approval** - The formal document of approval by the Commission for works or activities built or undertaken in rivers or lakes that flow along or across the international boundary under Articles III and IV of the Boundary Waters Treaty.

**Regulation plan(s)** - A set of rules used to determine the release of water from a lake. The rules are designed to achieve certain socio-economic and environmental objectives, while adhering to specific physical and operational limits.

**Rule curve** - Limits or guidelines (rules) on how water levels should be maintained in a lake or reservoir throughout a year.

**Study board** - An IJC board created to investigate specific issues usually related to either water quality or levels and flows.

**Topo bathymetric LIDAR** - Bathymetry is the study of the beds or floors of water bodies. LIDAR is a remote-sensing technology that uses pulses of laser light to make measurements of the surface.

**Watershed board** - An IJC board that with responsibilities regarding levels and flows and in addition addresses issues of water quality and ecosystem health in the watershed.



Lake in Minnesota, United States

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