Canada Water Act

Annual Report to Parliament 2023 to 2024

Environment and Climate Change Canada
Environnement et Changement climatique Canada

Canada

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MINISTER'S MESSAGE

I am pleased to present the 2023–2024 *Canada Water Act* Annual Report to Parliament and Canadians.

The newly formed Canada Water Agency continued its important work from within Environment and Climate Change Canada while legislation proceeded through the Parliamentary process leading to the *Canada Water Agency Act* coming into force in October 2024, and the launch of the stand-alone Canada Water Agency. Through strong partnerships with provinces, territories, Indigenous peoples and stakeholders, the Agency addresses national and regional freshwater priorities. The Agency leads with excellence in the management and stewardship of fresh water in Canada for the environmental, social, economic, and spiritual well-being of Canada and future generations of Canadians. Notably, the Agency began organizing pre-engagement with partners and stakeholders for the federal government's upcoming review of the *Canada Water Act* in 2025.

Water management in key Canadian water bodies is active and dynamic. This report describes varied operations and activities conducted under the authority of the Act, including, for example, freshwater monitoring across the country through the extensive national hydrometric monitoring network. Freshwater quality monitoring and groundwater research are also crucial to understanding the extent and health of Canada's water. The report describes the federal government's numerous water quality research efforts and groundwater-related activities, ranging from aquifer characterization to watershed modelling.

Across Canada, provinces, territories, Indigenous peoples, local authorities, scientists, other groups and citizens are working together to find the best ways to keep our water safe, clean and well-managed for future generations.

The Honourable Julie Dabrusin
Minister of Environment and Climate Change

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1 Introduction

The *Canada Water Act* (the Act) is administered by the Minister of Environment and Climate Change. It provides a framework for collaboration among federal, provincial and territorial governments in matters relating to water resources. To date, over 40 agreements on water quality and quantity have been formally authorized under the Act. Environment and Climate Change Canada's (ECCC) scientific efforts in water management are enabled by these agreements, allowing ECCC to conduct water research and monitor the conservation, development, and use of Canada's water resources.

Part I of the Act provides for the establishment of federal-provincial/territorial arrangements and programs in relation to water resource management. It also enables the Minister of Environment and Climate Change, independently or with others, to conduct research, collect data, and establish inventories on water resources. This part of the Act has been used since the Act came into force in 1970.

Part II of the Act provides for the establishment of federal-provincial/territorial management agreements applicable to designated water quality management areas that are federal waters, or where water quality has become a matter of urgent national concern. It also allows for the planning and implementation of water quality management programs and prohibits pollution in the designated areas. This part of the Act has never been used.

Part III of the Act provided for regulating the concentration of nutrients in cleaning agents and water conditioners. This part was repealed in 1985 and is now incorporated into the *Canadian Environmental Protection Act, 1999* (sections 116–119).

Part IV of the Act contains provisions for the general administration of the Act, including annual reporting to Parliament, inspection and enforcement, advisory committees, and public information programs.

Water management in Canada is a responsibility shared between federal, provincial, territorial, and Indigenous governments. The Act is one piece of a legislative framework providing the federal government water management authorities across Canada.

In addition to authorities under the Act, the federal government is involved in water-related areas such as fisheries, pollution prevention, shipping and navigation, international relations, domestic transboundary waters, and the creation and management of protected areas. The federal government is also responsible for management of water on federal lands. Other key pieces of federal legislation with direct links to water management include the following: *Department of the Environment Act*; *Fisheries Act*; *Migratory Birds Convention Act, 1994*; *Canadian Environmental Protection Act, 1999*; *Arctic Waters Pollution Prevention Act*; *International Boundary Waters Treaty Act*; *International River Improvements Act*; and *Canadian Navigable Waters Act*.

Canadian provinces and territories have significant responsibility over areas of water management and protection within their borders, including water allocation and use, drinking water and wastewater services, source water protection, managing inland fisheries, aquatic species at risk, and invasive species.

Under many historic and modern treaties, and self-government agreements, Indigenous peoples have water-related rights. Indigenous peoples are also involved in transboundary water management, including through water management boards. Water management also intersects with Aboriginal and treaty rights recognized and affirmed by section 35 of Canada's *Constitution Act, 1982*.

This report describes a wide range of federal operations conducted under the authority of the Act between April 1, 2023 and March 31, 2024. This includes participation in federal-provincial/territorial agreements and arrangements, significant water monitoring and research, and public information programs. It also includes work done under the Act to safeguard the water quality and quantity of Canada's watersheds.

Highlights of the 2023–2024 annual report

- The Canada Water Agency is leading the development of a National Freshwater Data Strategy and has begun engagement with other federal departments and agencies, provincial, territorial, and Indigenous partners, and other stakeholders.
- ECCC's National Hydrological Service (NHS) Renewal Initiative invested $89.7M to enhance Canada's water monitoring through improvements in forecasting, infrastructure, and data quality. Key advancements included faster data processing, quality control for winter records, and innovative non-contact technologies, such as surface velocity radars, to improve accuracy in water monitoring. Additional subjects of focus included improved telemetry systems and satellite communication.
- ECCC continued to deliver essential water quantity data through a network of over 2,900 hydrometric stations, with substantial contributions from provincial and territorial partners. This network of stations provided essential data for water management, flow forecasting, sustainable water use, and science applications.
- ECCC conducted several training sessions in British Columbia First Nation communities with Indigenous Guardians focusing on water quality and benthic macroinvertebrate sampling techniques. These joint site visits also provided valuable opportunities to discuss common interests and share knowledge. In addition, ECCC also collaborated with the Province of British Columbia and First Nations to establish new water quality monitoring sites on the Muskwa and Stikine Rivers.
- In 2023–2024, ECCC began testing an ecosystem sampling approach, involving multiple media, in the St. Lawrence River that will allow for a more precise and robust assessment of the quality of the aquatic environment.
- A number of significant hydrological events in Canada highlighted the importance of water quantity observations across the country. In July 2023, Nova Scotia experienced devastating flash floods, resulting in significant damage and the tragic loss of life. In September, post-tropical storm Lee brought widespread flooding to Atlantic Canada. Meanwhile, western provinces and the southern Northwest Territories faced severe drought conditions, impacting agriculture and water supplies.
- The NHS supported transboundary water management with the United States and contributed to global water assessments through the World Meteorological Organization, nominating Canadian stations for WMO's Centennial Hydrological Program, which will result in a strong reliable global data set for climate change science.
- The Canadian Environmental Sustainability Indicators Program continued to update its state of the environment indicators on topics related to water, biodiversity, and the climate, such as water quality and quantity in Canada, Snow cover, and Temperature change in Canada. These indicators support reporting on the *Canada Water Act* and other Acts, such the *Canadian Environmental Protection Act, 1999*, and strategies such as the 2030 Nature Strategy.
- ECCC enhanced public access to real-time hydrometric data through online platforms, such as Wateroffice, supporting open data initiatives.

Columbia River Valley, BC

2 Freshwater action

In Budget 2023, the Government of Canada announced an investment of $650 million over 10 years to renew and expand the Freshwater Action Plan and thereby strengthen the protection and restoration of freshwater bodies of national significance in Canada. To support the implementation of this investment and to strengthen federal leadership on fresh water, the Government of Canada created the Canada Water Agency as a branch within Environment and Climate Change Canada in June 2023. On October 15, 2024, the *Canada Water Agency Act* came into force, establishing the Canada Water Agency as a stand-alone agency.

Creating the Canada Water Agency presents a unique opportunity for Canada to work with provinces, territories, Indigenous peoples, local authorities, scientists, and others to strengthen collaboration, and find the best ways to keep our water safe, clean, and well-managed.

The Canada Water Agency is leading the development of a National Freshwater Data Strategy and has begun engagement with other federal departments and agencies, provincial, territorial, and Indigenous partners, and stakeholders. Once implemented, the Strategy will make freshwater data easier to access, strengthening freshwater-related decision-making.

The Canada Water Agency has also initiated early steps for a review of the *Canada Water Act* to assess how it may better reflect Canada's freshwater reality. The first phase of the review is pre-engagement, which includes preliminary discussions with Indigenous partners and provinces and territories, focusing on developing a collaborative process for engagement on the review of the *Canada Water Act*.

Water reflections in Halifax, NS

3 Freshwater monitoring

ECCC is the federal department responsible for collecting, interpreting, and providing critical standardized water quantity and water quality information that Canadians and their institutions need to make informed water management decisions to protect and provide stewardship of fresh water in Canada.

ECCC, in collaboration with provincial and territorial governments and others, conducts three types of monitoring in fresh water across Canada to obtain information on water quantity, freshwater quality, and biological condition. In certain cases, Indigenous peoples, institutions, or volunteers assist with monitoring.

3.1 Water quantity monitoring

ECCC provides for the collection, interpretation, and dissemination of surface water quantity data and information that is vital to meet both water management and environmental needs across the country. Hydrometric agreements with each of the provinces and territories conducted under the authority of the *Canada Water Act*, which have been administered cooperatively since 1975, provide the framework for these monitoring activities.

3.1.1 National hydrometric monitoring network

In 2023–2024, the national hydrometric monitoring network consisted of 2,937 hydrometric monitoring stations.

Figure 1: National Hydrometric Monitoring Network

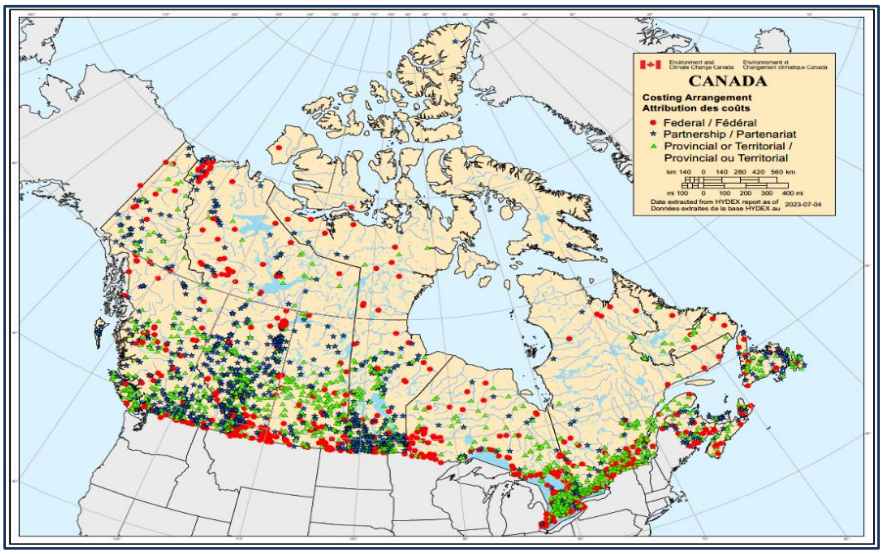


Table 1: Stations within the National Hydrometric Monitoring Network

Number of National Hydrometric Monitoring Network stations (by cost arrangement)						
Province/Territory[a]	**Federal**	**Cost-shared[b]**	**Province/ Territory**	**Third party**	**Non-ECCC-operated (various cost arrangements)**	**Total by province or territory**
Alberta	73	158	160	46	64	**501**
British Columbia	60	187	218	0	0	**465**
Manitoba	23.5	88	108.5	6	167	**393**
New Brunswick	14	22	27[c]	1	4	**68**
Newfoundland and Labrador	16	32	57	0	0	**105**
Nova Scotia	10	6	15	3	0	**34**
Northwest Territories	44	23	25	19	0	**111**
Nunavut	6	2	13	4	0	**25**
Ontario	142	88	328	14	7	**579**
Prince Edward Island	0	5	5	0	0	**10**
Quebec	12	0	0	0	254	**266**
Saskatchewan	92	51	17	3	141	**304**
Yukon	9	24	30	13	0	**76**
Total	**501.5**	**686**	**1,003.5**	**109**	**637**	**2,937**

[a] Hydrometric monitoring stations located within the boundaries of each province, no matter which office operates them.

[b] Stations that are partially funded by the federal government, provincial/territorial governments, and third parties. The cost-share ratio varies by station.

[c] Nine of these stations are groundwater stations. **Note**: The network also includes a small number of designated International Gauging Stations located in the United States that are not included here as they support International Joint Commission activities not covered under the *Canada Water Act*.

3.1.2 Regional highlights

Pacific Coast region

Leading up to the 2023 snowpack accumulation period, the extended cold, dry weather in November and December of 2022, resulted in limited snow accumulation in the mountains. In early 2023, the British Columbia (B.C.) snowpack increased significantly to near normal by March 1st, with the average of all snow measurements across the province measuring 94% of normal. La Niña conditions were expected to lead to increased late season snowfalls and delayed onset of snowmelt. However, extreme, unseasonably hot weather during the first two weeks of May generated rapid melting of the snowpack. Freshet and associated localized flooding occurred in many basins at least two-weeks earlier than usual in 2023, with many rivers experiencing the highest flows on record for that time of year. By mid-June, all regions throughout the province reported snow free conditions, which was earlier than any year on record.

Freshet refers to a snowmelt, an annual high water event on rivers resulting from snow and river ice melting.

Following the rapid melt of the provincial snowpack, all regions experienced prolonged drought conditions throughout the summer months of 2023. Many basins experienced the lowest July flow and water levels on record. The hot, dry weather contributed to severe wildfire conditions, specifically in the northeastern portion of B.C. Between June and August, five hydrometric gauges and their associated infrastructure, including gauge houses, cableways, and metering bridges were destroyed by wildfire. This resulted in a significant loss of ECCC's Water Survey of Canada (WSC) infrastructure. Between April and October, wildfires burned the most hectares in a season in B.C.'s recorded history. The widespread wildfire coverage restricted access to many hydrometric gauges, depending on rapidly evolving regional evacuations, including the significant evacuation of West and North Kelowna due to the McDougall Creek fire on August 17th, 2023.

McDougall Creek fire

Localized rain events resulting in typical periods of highwater on the southwest coast of the province persisted throughout the 2023 winter period. However, the Kootenay region experienced a substantial rain-on-snow event in early December, resulting in much higher-than-average stream

flows for the area late into the year. Much of the rest of the province transitioned directly from summer drought conditions to winter freeze-up, with little precipitation falling as rain.[1]

Northern Canada

Northwest Territories

Water level conditions across the territory varied, with conditions ranging from slightly below normal to normal in the eastern portion. However, the Mackenzie Basin experienced lower-than-average conditions for much of the season due to reduced precipitation beginning in 2022. These low water levels impacted navigation and transportation, requiring significant changes to how goods were distributed to communities along the Mackenzie River that typically rely heavily on barge operations for re-supply.

Breakup conditions led to some localized flooding in various communities, prompting local states of emergency due to ice-affected water levels. During these events, the NuPoint satellite camera installations and the images collected during ECCC's Water Survey of Canada fieldwork, provided valuable information to the partners, which helped to better inform emergency management groups about the potential severity and timing of ice-related flooding. The gauge at Peel River above Fort McPherson was impacted by the breakup, necessitating the installation of a temporary gauge during the ice jam event to provide crucial water level information to emergency management groups.

In August 2023, a city-wide evacuation of Yellowknife was ordered due to wildfire activity, which impacted hydrometric operations in the territory. ECCC staff and families complied with the order, remaining away from their community and homes for over 22 days. Despite these challenges, ECCC staff resumed operations shortly after the 22-day evacuation order.

[1] Source information: British Columbia Ministry of Environment and Climate Change Strategy's Snow Survey Program, British Columbia River Forecast Centre and British Columbia Wildfire Service (Snow survey data - Province of British Columbia (gov.bc.ca))

Nunavut

Water level and flow conditions for 2023–2024 varied across the territory, with above average levels in the southeastern regions during open-water season, which transitioned to below average during the summer months. Below average conditions persisted in the north, while gauges on Baffin Island recorded above average flows. The onset of breakup and freshet occurred earlier in the season than average, and the region additionally experienced a delayed freeze up. The shortened period of ice cover added to already challenging logistics, given that northern stations require ice to access (safely land aircraft) and conduct field measurements. As a result, some station visits had to be cancelled due to poor ice conditions in the early/late winter periods.

The city-wide evacuation of Yellowknife in August 2023 also affected hydrometric operations in Nunavut, since the Nunavut program is operated out of Yellowknife. Operations in Nunavut were also halted until shortly after the 22-day evacuation period as Yellowknife-based ECCC staff and their families were forced to evacuate.

Prairie region

Alberta (AB)

In June 2023, West Central Alberta experienced a significant high-water event that affected the Athabasca River watershed, including the McLeod River, Pembina River, and their tributaries. This event prompted record or near-record high water measurements, resulting in substantial infrastructure damage. Notably, the gauge and equipment were flooded at Rat Creek near Cynthia in June of 2023. Field crews were able to reuse the gauge shelter with new monitoring equipment installed. The traffic bridge washed-out at the site, was replaced shortly thereafter. Cableways at Embarras River near Weald and McLeod River above Embarras sustained damage. Most aircraft markers were destroyed but deemed functional after repair. Several sensors in the area were replaced after failing during the high-water event.

In contrast, the eastern part of the province, including Cold Lake, Ponoka/Wainwright and parts of Edmonton Northwest and Southwest, experienced an uneventful freshet and no significant hydrological events with water levels remaining on the lower end of yearly averages. Northwestern Alberta faced different challenges as wildfires impacted the region, complicating field crew operations and accommodations. In late summer, wildfires destroyed the gauge walk-in shelter at Chinchaga River Near High Level, necessitating an improvised temporary shelter for data collection.

High-water events were significant not only in West Central Alberta but also affected stations in Slave Lake, Athabasca, Peace River, and Grande Prairie. Meanwhile, record low water conditions were experienced on the Peace River due to the filling of the Site C Dam, with the lowest measurements on record obtained during the 2023 operating season. Low water conditions were prevalent throughout the region, particularly around High Level, AB.

Peace River in Alberta

In hydrology, "stage" is the water level in a river or stream with respect to a chosen reference height. It is commonly measured in units of feet.

The Fort McMurray and Peace-Athabasca Delta regional breakup in May 2023 was uneventful with minimal damage to hydrometric monitoring equipment. However, low water levels were observed immediately following ice out and into the high-water season. Heavy rains in June 2023 in the Edson/Whitecourt area led to high water levels in the Athabasca Basin, resulting in a stage rise of 3 m over four days at Fort McMurray, which was the second-highest measurement ever recorded.

Fieldwork was further complicated by forest fires and smoke, leading to flight cancellations, particularly in the Fort Chipewyan area, which faced full evacuation in June 2023. Despite these challenges, most sites were visited within a reasonable timeframe. For the remainder of the 2023 open water season, water levels were relatively low compared to previous years. From January to March 2024, low discharge rates were measured on the Athabasca River below Fort McMurray. This prompted increased measurement frequency due to the heavy reliance of industrial users downstream in the form of water withdrawals for oilsands processing and refining.

Southern Alberta experienced generally low water levels in 2023 due to low snowpack and prolonged absence of precipitation during summer, which led to extreme low water conditions in the southern prairies. Additional surveillance was required, and some reservoirs, including Oldman Reservoir and St. Mary Reservoir, were at record low levels during late summer. However, isolated heavy rains in northern Montana in early spring provided sufficient flows to fill United States (U.S.) reservoirs. This particular set of circumstances allowed Canadian irrigators to extend their irrigation season due to the international (U.S./Canada) *St. Mary and Milk River Apportionment Agreement*, which provides transboundary water apportionment guidance.

Saskatchewan (SK)

Rapid snowmelt resulted in peak flows exceeding expectations over much of South-Central Saskatchewan. Observed discharge peaks ranged from 1-in-5 to over 1-in-50-year events. Rush Lake Creek observed the largest peak flow within observed records. ECCC technologists measured historic high peak flows at Rush Lake Creek above Highfield Reservoir on April 12th, 2023, exceeding the previous measurement by 76%.

Across the remainder of the south, the spring response was generally near normal. The North and South Saskatchewan River Basins generally experienced a near or below-average spring freshet. The Churchill River Basin and basins farther north saw a well below normal runoff response in spring 2023.

Below to well below normal streamflow across the province was observed for the summer and fall. Flows in the southeast, including Long, Moose Mountain, and Pipestone Creeks, had near normal late season flows due to late October precipitation events. Moderate to extreme drought conditions occurred in fall 2023 across most of western and southern Saskatchewan.

In the north, flows were below normal due to drier conditions. Severe drought persisted and slightly expanded between Reindeer Lake and Buffalo Narrows, with less than 50% of normal precipitation falling between July to October, resulting in well below normal streamflow. On October 3, 2023, ECCC operational technologists measured the second lowest flow in recorded history at Charlot River at Outlet of Webb Lake. This low flow observation was surpassed by 70% on January 15, 2024, during a period typically marked by low flow conditions.

Manitoba

Manitoba had a normal snowpack and an overall normal spring freshet in most areas in 2023. However, a rapid melt in some areas led to some high peak flows in the Pembina area, which had the largest relative peaks of any field site in Manitoba in the spring of 2023. Two of the highest flow measurements in the period of record were achieved in the Pembina River Basin in the spring of 2023. These included a stage measurement of 48.2 m at Pembina River North of Killarney and 44.8 m recorded on April 14th, 2023 at Long River near Holmfeld.

Red River in Manitoba

The remaining areas in southern Manitoba had low to moderate peak flows in spring. The majority of gauges peaked for the operating period in spring then had a steady recession through the summer

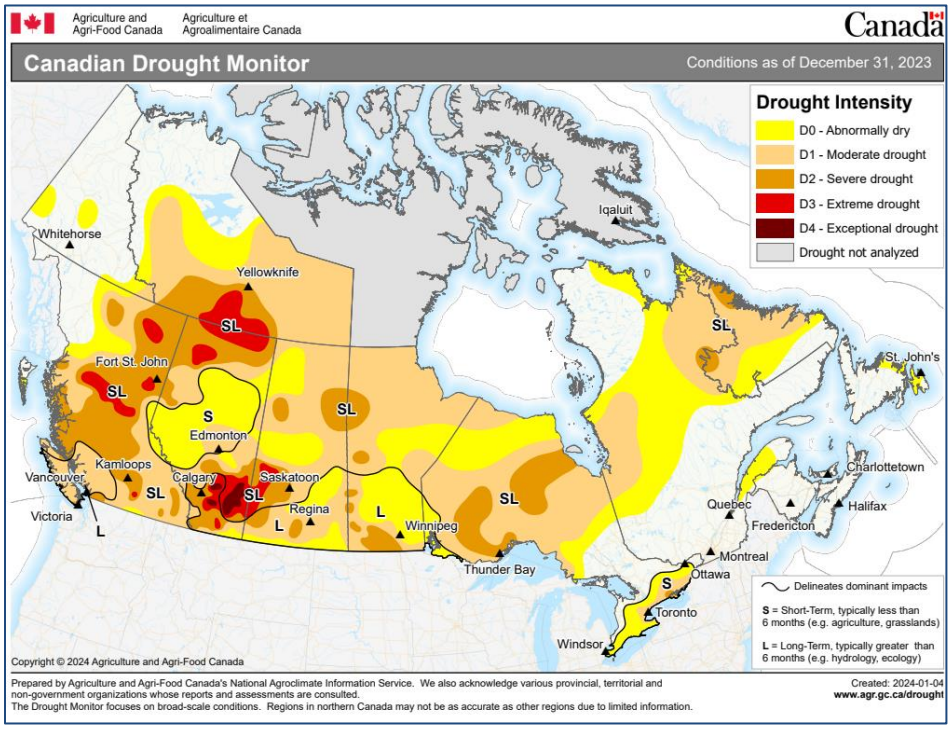
and into the fall due to minimal precipitation. The low precipitation amounts led to moderate to extreme drought throughout southern Manitoba by late September. Due to widespread drought conditions over the prairies, gauges recorded low levels over the latter half of the operating (open-water or ice-free) period. Many rivers were affected by backwater from aquatic vegetation and beaver activity and needed to have their rating curves corrected accordingly.

Winter conditions were late to arrive in 2023, resulting in open water persisting well into the fall. This prompted poor ice conditions and access issues at many gauges in December and early 2024. Notably, a large amount of water from precipitation events in the U.S. caused a rare rise in stage during ice cover on the Red River.

Northern Manitoba experienced notably low flows and water levels in 2023. The stage for the Reindeer Lake station, which is regulated by Whitesand Dam, was low for 2023 and the lowest on record in early 2024. In 2023, the spring freshet was short and the peak water levels did not reach the previous year's peak at many stations. The water levels receded in July and did not rise until winter conditions caused ice formation. In 2023, many sites had unsafe ice conditions later into the season than normal.

The Canadian Drought Monitor indicated that the majority of the province experienced Extreme Drought to Moderate Drought from June through December.

Figure 2: The Canadian Drought Monitor



Ontario region

French River in Ontario

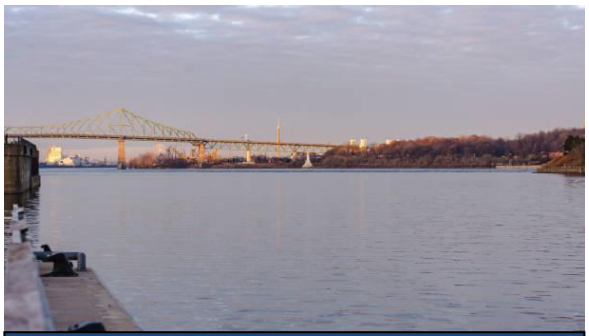
Water level and flow conditions for 2023–2024 were generally within the normal ranges expected seasonally in the region, with exceptions. There was some localized flooding throughout southern and eastern Ontario as the result of several short duration high-water events in spring 2023, as well as late winter 2024. Late spring 2023 experienced some higher-than-average water levels in the Near North region, including the French River (Lake Nipissing). In August, some typical heavy rainfall events resulted in the closure of a divided highway between London and Sarnia. This incident was summarized as part of the top 10 weather stories in Canada for 2023. On August 23 and 24, a steady stream of showers and thunderstorms pushed through southwestern Ontario resulting in precipitation totals of as much as 185 mm in several locations. The resulting flooding led to road washouts and the tragic death of a trucker who perished in a 3 m deep sinkhole. The greatest rainfall totals exceeded 200 mm in Pelee Island and Harrow, Ontario. (Canada's top 10 weather stories of 2023 - Canada.ca)

Relatively dry conditions in Ontario through the winter of 2023 led to a busy forest fire season across northern Ontario, and spring fire-bans in all provincial parks until July, when some rain events provided some relief in the south. Some delays were experienced operating in northern Ontario due to aircraft availability linked to forest fires, but this did not ultimately impact operations.

Quebec region

There were no extreme events in the area of coverage of federally-operated gauges.

Federally-operated gauges in Quebec are a limited network, in a confined geographic area around the Montreal archipelago and on the lakes that border the United States. This year, improvements to physical gauge infrastructure continued, including gauge relocation planning for increased sustainability on the Island of Montreal.



St. Lawrence River in Montreal

To support the activities of the Meteorological Research Division in the Quebec City area, a team of 12 Ontario staff conducted operations over three days for the Surface Water and Ocean Topography (SWOT) project on the St. Lawrence River. They operated two larger boats in two shifts daily, collecting velocity and discharge data in the Port of Quebec City and both channels around Île d'Orléans. Support work for projects near the St. Lawrence River was conducted, which included

facilitating vegetation surveys for eco-hydraulic modelling. Ontario staff also provided additional support, in coordination with the Great Lakes – St. Lawrence Regulation Office, to the International Joint Commission's (IJC) Lake Ontario – St. Lawrence River Board. They conducted inspections and verification surveys of water level measurements stations along the St. Lawrence River, in support of Canada's transboundary water management responsibilities.

Atlantic region

In September 2023, post-tropical storm Lee caused significant flooding and damage across Atlantic Canada, particularly in Nova Scotia and New Brunswick. The storm brought heavy rains, with some areas reported to have received up to 100 millimeters, leading to widespread flooding. Coastal areas experienced storm surges, exacerbating the flooding and causing road closures and property damage.

New Brunswick

New Brunswick started the reporting period off with a very dry spring in 2023, resulting in May having the lowest flow readings for many gauges in the province for the year. These conditions changed with the onset of very wet conditions in June, July and August, with some gauges reporting the highest seasonal flows on record. The winter of 2024 was mild with few ice measurements obtained in the southern part of the province and fewer than average in the north.

Nova Scotia

The dry spring in 2023 experienced in much of Atlantic Canada resulted in minimum flows for Nova Scotia for the year occurring in May and June at many stations. The dry spring was followed by a very wet summer, with the months of June, July and August being the wettest on record in many parts of the province. The Halifax area received a significant rainfall event on July 21st, 2023 with over 200 mm of rain falling in 24 hours in areas around the city. This heavy rainfall over the relatively short period in an urban setting led to tragic consequences, with four lives lost and extensive infrastructure damage, including washed-out or damaged roads, bridges and dams.

Prince Edward Island

Prince Edward Island started spring very dry, with the lowest flows of the reporting period seen in May, but experienced a very wet June, July and August. A relatively mild winter combined with rain in late winter and early spring, resulting in high flow events through the latter part of the reporting period.

Newfoundland and Labrador (NL)

Newfoundland and Labrador followed a hydrologic pattern similar to that of other Atlantic Provinces with a very dry spring followed by unusually high precipitation in June, which led to high-flow events. Heavy rainfall caused flooding near Roddicton on the Northern Peninsula, where Gauge 02YD002 on the Northeast River at Roddicton recorded a peak flow of 113 cubic meters per second (m^3/s) on June 9, 2023, substantially exceeding the 1-in-100-year streamflow of 68.4 m^3/s. Another significant rainfall event impacted the southwest coast in the Corner Brook–Port Aux Basques area from July 22–23, causing infrastructure damage. On July 23, the Isle aux Morts River Below Highway Bridge Gauge peaked at 555 m^3/s.

In mid-December 2023, NL experienced an exceptionally rare high-flow event due to record high temperatures above freezing. The Exploits River at Badger in central NL recorded peak flows of 1,630 m^3/s on December 22, driven by a combination of snowmelt and rain; this was notably higher than the preceding winter baseflow of approximately 220 m^3/s. The winter months of 2024 remained relatively mild with below-average snowpack, leading to a largely uneventful spring freshet period.

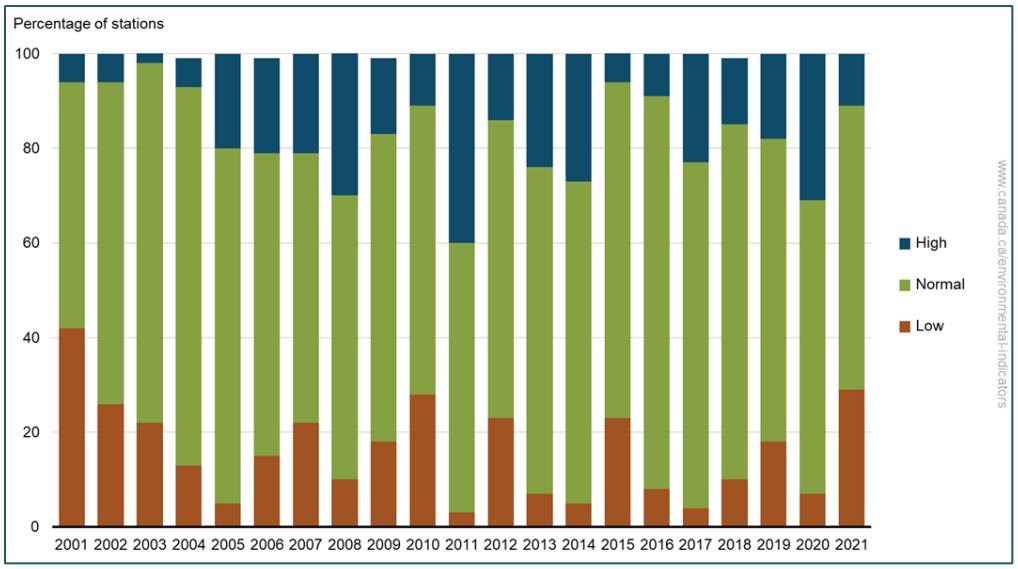
3.1.3 Water quantity in Canadian rivers indicator

The Canadian Environmental Sustainability Indicators (CESI)[2] program provides data and information to track Canada's performance on key environmental sustainability issues including climate change and air quality, water (including water quality and quantity), biodiversity and pollution. The program updates many of its indicators annually, with others on an occasional basis based on data availability. Much of the data used to develop these water indicators derives from monitoring activities conducted pursuant to hydrometric agreements concluded under the *Canada Water Act*.

The water quantity in Canadian rivers indicator is published every two years. The last publication was in March 2024. It provides a summary of trends in water quantity in rivers across Canada from 2001 to 2021.

[2] Note that because of the time required to collect and analyze the data, and draft the indicators, the data used in the indicators are always 2-3 years behind the publication date.

Figure 3: Water quantity at monitoring stations, Canada, 2002–2021



Note: The water quantity classification for a station is based on a comparison of the annual water quantity in a given year with the typical annual water quantity at that station between 1991 and 2021. For more information, please visit the CESI indicator page.
Source: Environment and Climate Change Canada (2023) National Water Data Archive (HYDAT).

3.2 Freshwater quality monitoring

ECCC monitors freshwater quality on federal lands, transboundary watersheds, and inland waters in partnership with provinces and territories, as well as contributing to the understanding of water quality of priority ecosystems. Many of the Freshwater Quality Monitoring Program's activities are carried out through federal-provincial/territorial agreements, ensuring cost-effective and non-duplicative program delivery. ECCC has water quality monitoring agreements with British Columbia, Yukon, Quebec, Prince Edward Island, New Brunswick, and Newfoundland and Labrador. The data from Manitoba, Saskatchewan, Alberta, and Nova Scotia are provided from provincial monitoring sites.

3.2.1 Long-Term Freshwater Quality Monitoring Network

The Long-Term Freshwater Quality Monitoring Network comprises federal, federal-provincial and federal-territorial sampling sites across Canada, managed through regional programs that operate within Canada's major watershed boundaries. In 2023–2024, 496 sites were sampled as part of ECCC's long term freshwater quality monitoring network at river and lake sampling sites across Canada. Water quality samples are routinely collected at these sites for physical and chemical water quality parameters such as temperature, pH, alkalinity, turbidity, major ions, nutrients, and metals. Pesticides, bacteria, and additional water quality parameters of concern are also monitored where relevant to agreements to which the federal government is party and/or to other program objectives.

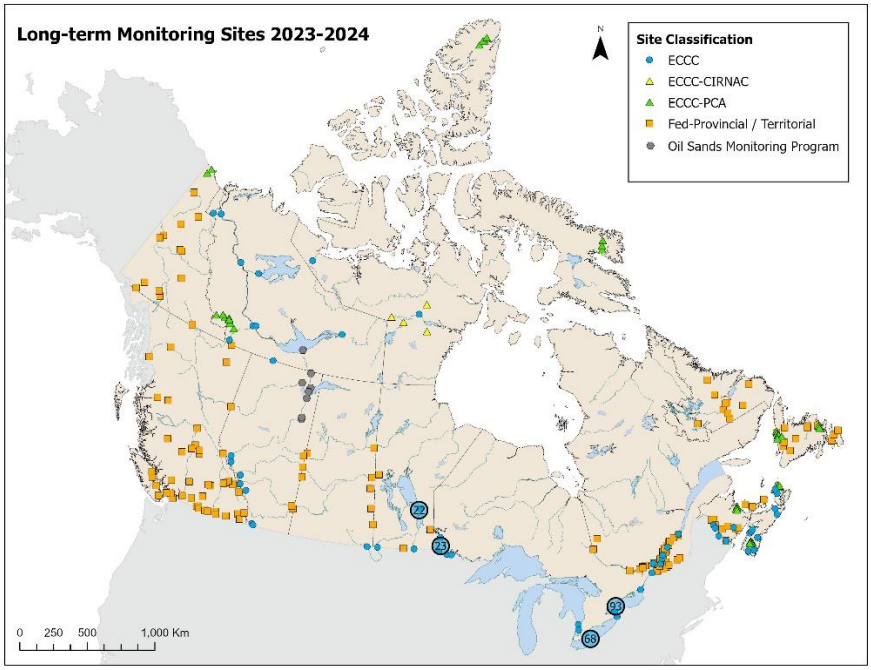
Water quality monitoring in 2023–2024 was carried out in collaboration with others as follows:

- Provinces and Territories at 154 sites;
- Parks Canada at 77 sites in 12 national parks (monitoring on federal lands);
- Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) at four sites in northern Canada (assessment of aquatic ecosystem health and cumulative effects in the mainland Nunavut region);
- Key stakeholder groups/agencies within priority ecosystems areas under the Freshwater Action Plan through water quality surveys and sampling events on the Great Lakes, Lake Winnipeg, Lake of the Woods, and the St. Lawrence watersheds; and
- Binational (Canada-U.S.) partners through International Joint Commission (IJC) Boards and Committees in several transboundary watersheds.

The long-term monitoring sites sampled in 2023–2024 are shown in the following map below.

Data are published online to Open Canada on a monthly basis (see Section 8 for more information on access to these datasets).

Figure 4: Long-term water quality monitoring sites sampled in 2023–2024



Note: Large lakes are presented as a single marker representing a network of individual monitoring sites sampled on a rotational basis.

Table 2: Sites within ECCC's long-term water quality monitoring networks

Monitoring mechanisms							
Province/Territory	**ECCC**	**Federal-Provincial/ Territorial Agreement**	**ECCC-Parks Canada**	**ECCC-CIRNAC**	***Joint Canada-Alberta Oil Sands Monitoring Agreement***	**Total [a]**	**ECCC priority ecosystem and program areas [b]**
Alberta	0	4	7	0	8	19	Mackenzie River Basin (10), Lake Winnipeg Basin (8)
British Columbia	0	51	0	0	0	51	Fraser River Basin (15), Mackenzie River Basin (4)
Manitoba	25 [c]	3	0	0	0	28	Lake Winnipeg and Basin (28)
New Brunswick	5	9	5	0	0	19	Wolostoq Saint John River Basin (12)
Newfoundland and Labrador	0	24	17	0	0	41	0
Nova Scotia	10	0	30	0	0	40	0
Northwest Territories	9	0	9	0	1	19	Mackenzie River Basin (19)
Nunavut	2	0	7	4	0	13	0
Ontario	194 [d]	0	0	0	0	194	Lake of the Woods/Lake Winnipeg Basin (27), Great Lakes (167)
Prince Edward Island	0	3	0	0	0	3	0
Quebec	6	39	0	0	0	45	St. Lawrence River basin (45)
Saskatchewan	1	7	0	0	0	8	Lake Winnipeg Basin (6) [e]
Yukon	0	14	2	0	0	16	Mackenzie River Basin (3)
TOTAL	252	154	77	4	6	**496**	

[a] Total number of sites by province and territory through ECCC, Federal-Provincial and Federal-Territorial agreements, Memorandums of Understanding with Parks Canada and CIRNAC, and the Joint Canada-Alberta Oil Sands Monitoring Program.

[b] Indicates the number of sites located in Priority Ecosystems and Program areas among long-term freshwater quality monitoring networks including riverine and lake sites.

[c] Only six of the Saskatchewan sites are part of the Lake Winnipeg Basin. The remaining two sites are part of the Churchill River watershed.

ECCC's monitoring and surveillance activities are guided by a risk-based adaptive management framework (RBAMF). The RBAMF is a set of tools, analysis, and procedures to guide the optimization of ECCC water quality network operations, including how, where and when to monitor based on a wide range of risks to water quality in a watershed, legislated responsibilities, and Government of Canada priorities. It provides an adaptive decision support tool to assess ongoing relevance through a plan-do-check-improve (PDCI) cycle and informs decisions on potential changes to the water quality monitoring network. This information also supports water management work done in transboundary watersheds and under Federal-Provincial-Territorial agreements.

In 2023–2024, ECCC assessed and updated the implementation of the RBAMF in the Lake Winnipeg and Great Lakes watersheds. This was the third region to undergo a risk-based assessment review in ECCC's five-year incremental approach to continual improvement. In preceding years, this review process was also conducted for ECCC water quality monitoring in the Pacific-Arctic-Athabasca region and the St. Lawrence-Atlantic region. This work is part of the department's five-year review of the RBAMF elements, as they apply to each drainage basin, to ensure continuous improvement of its

freshwater monitoring activities. The review was initiated following 2021-2022 recommendations from the Commissioner of Environment and Sustainable Development (CESD Audit[3]).

For more information, please consult the ECCC Freshwater Quality Monitoring website.

3.2.2 Regional highlights

St. Lawrence-Atlantic

In 2023–2024, ECCC began testing an ecosystem sampling approach in the St. Lawrence River that will allow for a more precise and robust assessment of the quality of the aquatic environment. This approach involves sampling multiple media in the same ecosystem. These media include, but are not limited to, water (dissolved and particulate fractions), benthos (benthic or bottom-dwelling organisms in water bodies), and sediment (dissolved and particulate), where chemical contaminants can accumulate. Through the St. Lawrence Action Plan, ECCC sampled 115 sites in Lake Saint-Pierre to assess the quality of this important aquatic ecosystem.

Remaining structures of the Milltown Dam on the Skutik St. Croix River
Photo: ©Neal Berry

In the Atlantic Region, the Milltown Dam on the Skutik St. Croix River was decommissioned in 2023 by New Brunswick Power after 141 years of operation. The dam was a barrier to fish passage and its removal has resulted in greater access to migrating diadromous fish along a 16 km portion of the river, as well as access for recreational and traditional uses. In 2023–2024, ECCC collaborated with the St. Croix International Waterway Commission (SCIWC) to sample 21 sites as part of a three-year project through the International Joint Commission (IJC) to better understand stressors and nutrient dynamics in the watershed, in addition to ECCC's two long-term water quality monitoring sites in the river.

In 2023–2024, ECCC staff co-authored a publication assessing long-term changes in lake water quality in the Halifax, Nova Scotia area over the past 40 years[4]. The study highlighted emerging

[3] CESD. 2021. Report 3: Scientific Activities in Selected Water Basins. Reports of the Commissioner of the Environment and Sustainable Development to the Parliament of Canada. Indepdent Auditor's Report. Office of the Auditor General of Canada. Retreived from: Report 3—Scientific Activities in Selected Water Basins (oag-bvg.gc.ca).

[4] Doucet C, Johnson L, Hiscock A, Bermarija T, Hammond M, Holmes B, Smith T, Lalonde B, Parent D, Deacoff C, Scott R, Kurek J, Jamieson R. 2023. Synoptic snapshots: monitoring lake water over 4 decades in an urbanizing region. Lake Reserv Manage. 39: 101-119 (Full article: Synoptic snapshots: monitoring lake water quality over 4 decades in an urbanizing region).

water quality concerns in this urban area including elevated aluminum concentrations and increasing chloride, nutrient, and arsenic levels.

Hudson Bay – Great Lakes


A temporary pier on Lake Winnipeg

In 2023–2024, ECCC completed a review of its RBAMF as it applies to the Hudson Bay-Great Lakes region (Lake Winnipeg and Lake Erie in particular) to ensure continuous improvement of its freshwater monitoring activities. The review also assessed alignment of ECCC's RBAMF with the multi-jurisdictional governance framework that is in place for these watersheds and examined the current status of nutrient monitoring efforts. The review demonstrated that ECCC's water quality monitoring activities in these watersheds and large lakes are highly integrated with other agencies. It also identified new improvements to the current monitoring network through upcoming plans to implement enhanced nutrient monitoring technology and activities as part of the continual cycle of improvement.

Pacific Arctic-Athabasca


Stikine region in BC

ECCC conducted several training sessions in BC First Nation communities with Indigenous Guardians. Although the focus was on water quality and benthic macroinvertebrate sampling techniques, these joint site visits provide valuable opportunities to discuss common interests and share knowledge. ECCC also collaborated with the Province of BC and First Nations to establish new water quality monitoring sites on the Muskwa and Stikine Rivers.

Whirling disease was discovered in Yoho National Park, impacting fish at two water quality monitoring sites. The Columbia River Basin has been identified as a possible source for the disease and likely affects fish at 21 sites in the network. ECCC routinely follows decontamination protocols and special sample handling techniques as part of fieldwork protocols in this region to prevent impacts to fish due to parasite infection from this invasive disease.

In Alberta, ECCC continues to provide leadership for the Oil Sands Water Quality and Biomonitoring programs, in partnership with the Government of Alberta. ECCC provided several training sessions

with Métis and First Nations communities on aquatic biomonitoring and co-sampled sites of cultural significance.

3.2.3 Water quality in Canadian rivers indicator

St. Lawrence River near Quebec City

Data from monitoring are also used to support the water quality in Canadian rivers indicator developed under the Canadian Environmental Sustainability Indicators program (CESI). The water quality indicator provides an overall measure of the ability of river water to support plants and animals. The indicator is calculated using the water quality index endorsed by the Canadian Council of Ministers of the Environment to summarize the status of surface freshwater quality in Canada. This indicator reflects the extent to which water quality guidelines for the protection of aquatic life are being met at selected river monitoring sites throughout Canada. Water quality at a monitoring station is considered excellent when substances in a river are very rarely measured above their guidelines. Conversely, water quality is rated poor when measurements are usually above their guidelines.

The water quality in Canadian rivers indicator released in February 2024 is based on data collected from 2002 to 2022 at 177 water monitoring stations across Canada[5] at national and regional scales and reflects the diversity of watersheds in the country. The data were assembled from 16 federal, provincial, territorial, and joint water quality monitoring programs. The national water quality index was calculated for a core national network of 163 river sites, selected to be representative of surface freshwater quality in southern Canada where human pressures are most intense.

[5] Water quality is evaluated at an additional 152 monitoring sites across Canada (for a total of 329 sites). Although these additional sites were not used to calculate the indicators, water quality results for all 329 sites can be explored using the interactive water quality map. These additional 152 sites are not included in the calculations because they do not meet the minimum data requirements, or because including them would over represent the region.

For the 2020 to 2022 period, water quality in rivers in Canada was rated fair to excellent at 86% of the monitored sites. More specifically, water quality measured at these river sites across southern Canada was rated as excellent or good at 54% of monitoring sites, fair at 32% of sites, marginal at 12% of sites, and poor at 2% of sites. Land development through agriculture, mining, forestry, and high population density can all have a negative impact on water quality and the combination of these (mixed pressures) tends to show the highest percentage of sites with marginal and poor water quality.

Figure 5a: Water quality in Canadian rivers, 2020 to 2022 vs 2019–2021 periods

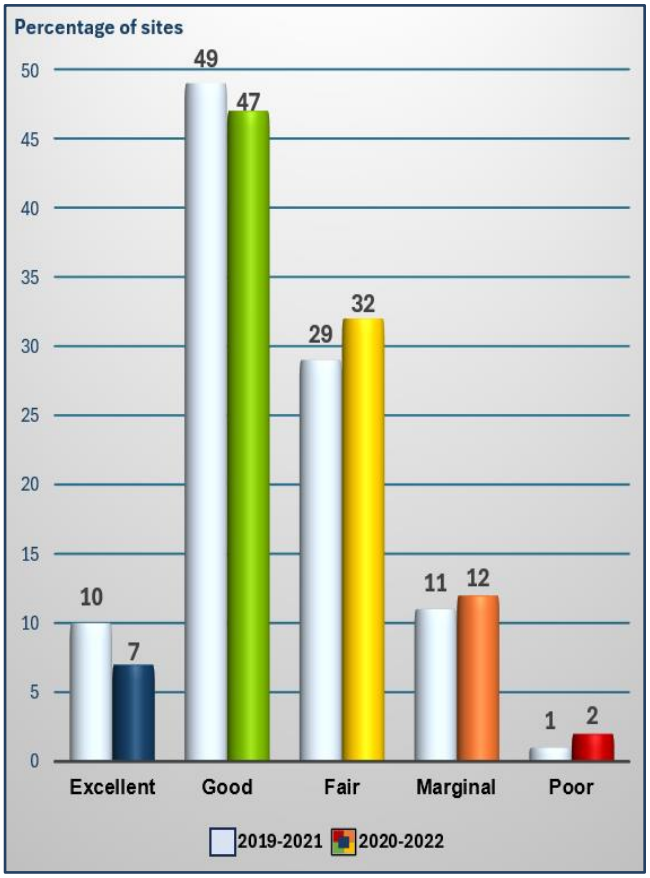
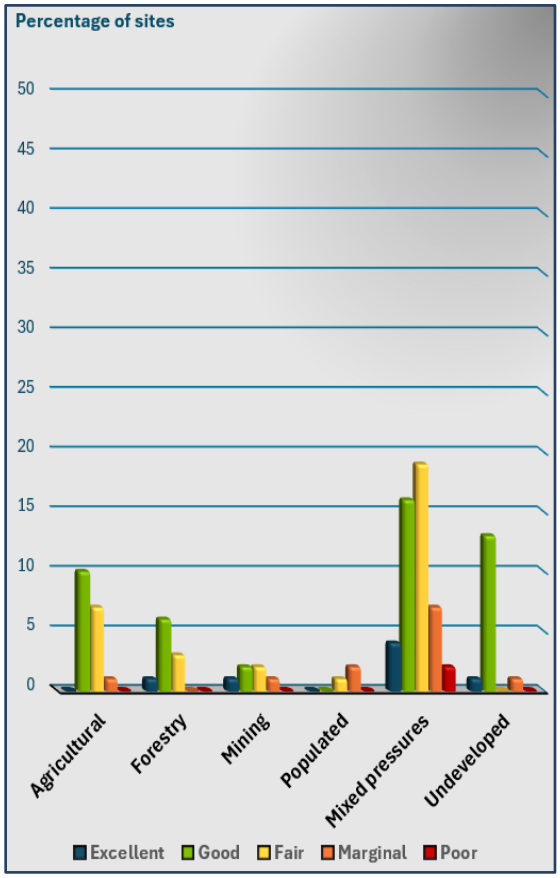


Figure 5b: Water quality by land use for 2020–2022



Source: Data assembled by ECCC from the Canadian Environmental Sustainability Indicators Program and other federal, provincial and joint water quality monitoring programs. Population, forestry, mining and land cover statistics for each site's drainage area were provided by Statistics Canada, Natural Resources Canada, ECCC, Agriculture and Agri-Food Canada, the Government of Alberta and the University of Maryland.

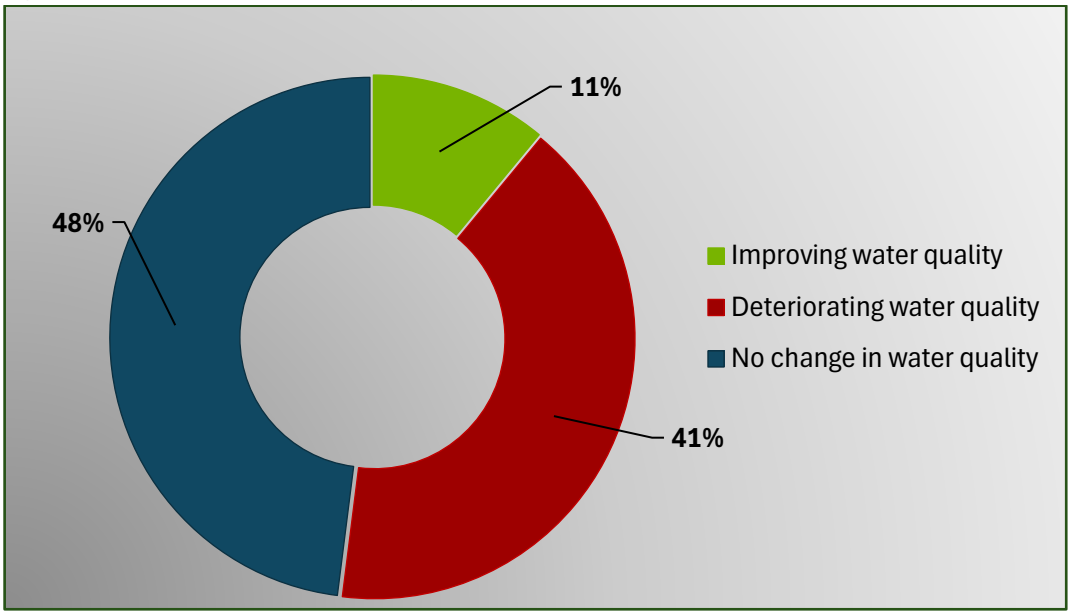
Note: Water quality was evaluated at 163 sites across southern Canada using the Canadian Council of Ministers of the Environment's water quality index. For more information on water quality categories, land use classification and monitoring sites selection, consult the Data sources and methods section of the Canadian Environmental Sustainability Indicators Program indicator page.

Due to health measures related to COVID-19, some sampling activities and laboratory analysis were cancelled in 2020. As a result, the method related to the calculation of the water quality indicator for the 2020-2022 period was adjusted due to the lack of available data at some sites in 2020. For this reason, the comparison of results between years and stations should be interpreted as indicative.

Trends in water quality

Overall, across 160 national freshwater quality monitoring sites, the water quality index results showed that nearly half of the monitoring sites across southern Canada (48%) showed no change in water quality over the 10-year period from 2002 to 2022 , while 11% showed improvement and 41% showed a decline in water quality for the same period.

Figure 6: Trends in water quality, Canada, 2002–2022



Note: The trend in water quality between the first year that data were reported for each site and 2022 was calculated at 160 sites across southern Canada. The trend was calculated at each site using parameters specific to the site. Therefore, an improving or a deteriorating water quality does not necessarily imply a change in water quality category. For more information on the trend method used, consult the CESI indicator page.

Source: Data assembled by ECCC from the Canadian Environmental Sustainability Indicators Program and other federal, provincial and joint water quality monitoring programs.

3.3 Biological monitoring

The Canadian Aquatic Biomonitoring Network (CABIN) is a collaborative network led and maintained by ECCC. It is a component of the Freshwater Quality Monitoring Program that assesses freshwater ecosystem health using benthic macroinvertebrates (organisms without backbones that live on and within the bottom of waterbodies and are large enough to be seen with the naked eye). Changes in types and numbers of benthic macroinvertebrates can indicate exposure to recent disturbances such as unusual flow conditions, pollution, or other changes in water quality and surrounding watershed conditions.

Benefits of benthic macroinvertebrates

Many insects such as mayflies, stoneflies, caddisflies, dragonflies and midges live in the aquatic environment in their early life stages before they develop wings. Many other organisms such as worms, mites, mussels and crayfish live in the aquatic environment through their entire life cycle.

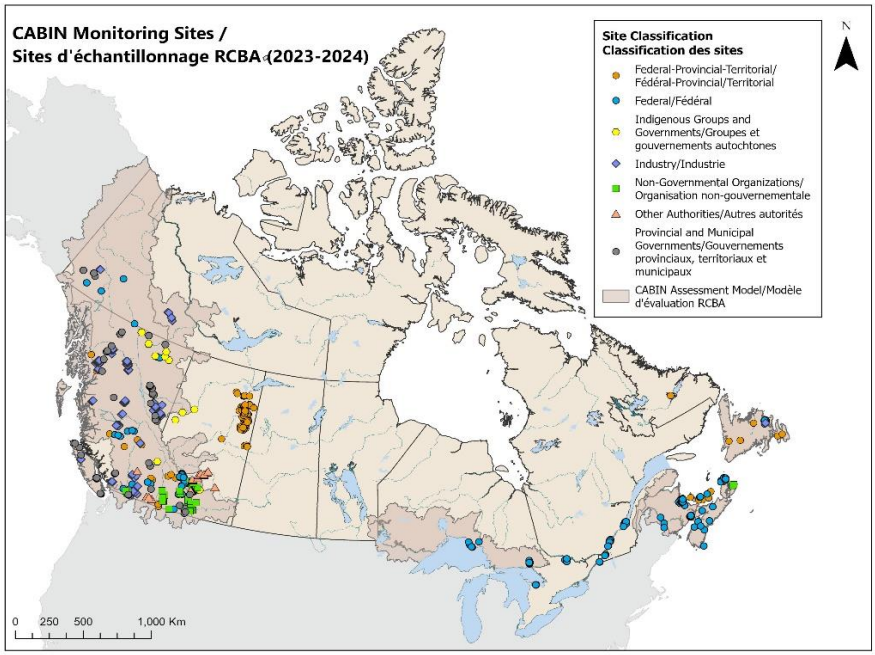
These organisms are good indicators of ecosystem health because they are found everywhere, they are easy to collect, they live at the same site for months to years, they are an important part of the aquatic food chain, and different kinds respond differently to environmental stressors.

CABIN provides nationally standardized protocols to monitor the health of aquatic ecosystems. Through the web-accessible CABIN database, network participants can share biomonitoring data and perform cost-effective and comparable assessments of ecosystem health across Canada. CABIN participants include federal departments, provincial and territorial governments, Indigenous groups, industry, academia, and nongovernmental organizations including community-based watershed groups.

ECCC conducts biomonitoring at long-term water quality monitoring sites to complement the physical-chemical status and trends assessments with biological health assessments. Network participants conduct biomonitoring across the country to support their own water management priorities (e.g., restoration or remediation effectiveness, resource development, impact assessment, or state of environment reporting).

For more information, please refer to the CABIN website.

Figure 7: CABIN monitoring sites, 2023–2024



Note: Reference sites represent habitats that are closest to "natural" before any human impact. The data from these sites are used to create reference models. CABIN partners use these models to evaluate their test sites in an approach known as the Reference Condition Approach (RCA). The extent of the differences between the test site communities and the reference site communities allows CABIN partners to estimate the severity of the impacts at those locations.

Table 3: 2023 CABIN sites sampled across Canada by various network partners

CABIN Network contributions								
Province/ Territory	**Federal**	**Federal-provincial/ Territorial[a]**	**Provincial, Territorial, and Municipal governments**	**Indigenous groups and governments**	**Industry and environmental consultants**	**NGOs**	**Other authority[b]**	**Total by province or territory[c]**
Alberta	36	102	0	13	0	25	19	**195**
British Columbia	20	18	56	23	265	30	5	**417**
Manitoba	0	0	0	0	0	0	0	**0**
New Brunswick	25	0	0	0	0	0	0	**25**
Newfoundland and Labrador	0	0	0	0	10	0	0	**10**
Nova Scotia	19	0	0	0	0	3	0	**22**
Northwest Territories	0	0	0	0	10	0	0	**10**
Nunavut	0	0	0	0	0	0	0	**0**
Ontario	27	0	0	0	0	0	0	**27**
Prince Edward Island	10	8	0	0	0	0	0	**18**
Quebec	18	0	0	0	0	0	0	**18**
Saskatchewan	0	0	0	0	0	0	0	**0**
Yukon	4	0	10	0	11	0	0	**25**
Total	**159**	**128**	**66**	**36**	**296**	**58**	**24**	**763**

[a] Includes CABIN sampling carried out through federal-provincial and federal-territorial agreements as well as sampling through a collaborative agreement between ECCC, Alberta, and Industry (Joint Canada-Alberta Oil Sands Monitoring Program).

[b] Indicates CABIN sites sampled as part of academic studies or by unknown authorities.

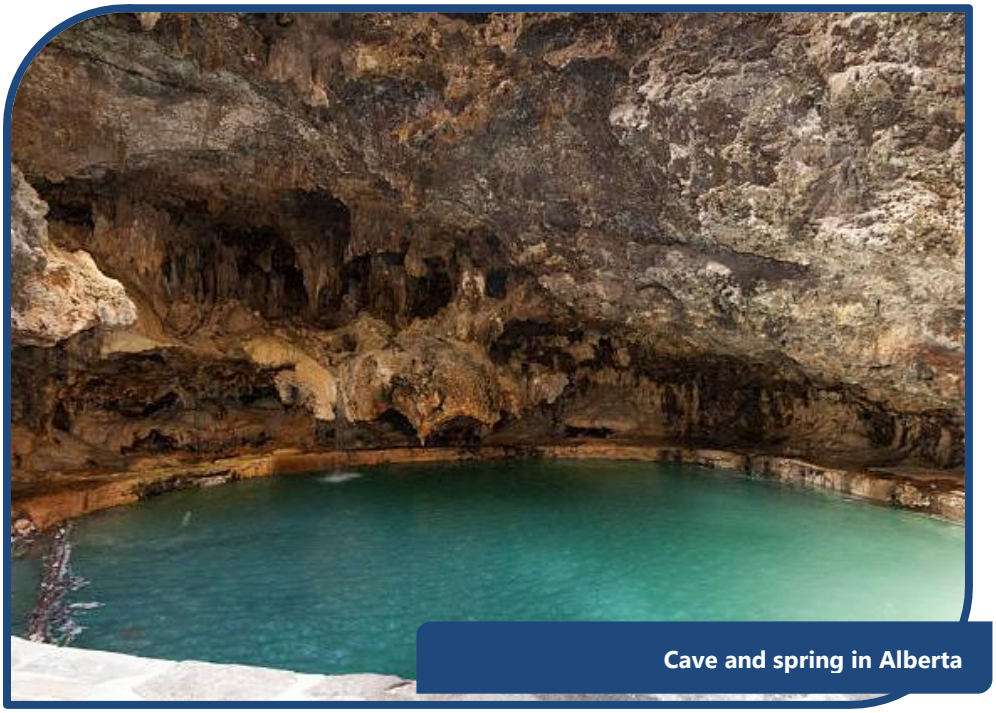
[c] Total number of samples contributed to CABIN shared database by province and territory.

CABIN Highlights

ECCC has provided certification for more than 2,500 people within the CABIN network, since its inception. In 2023, over 200 people from across the country participated in the online training program. Over 150 of those participants also attended one of the 20 field certification courses held across the country. ECCC published readily available, web-accessible resources (e.g., manuals, field sheets, checklists, quick reference guides, handbooks, and a Geographic Information System guidance document) for all network participants to easily incorporate CABIN into their water monitoring programs.

In 2023, ECCC and the Government of Newfoundland and Labrador and ECCC published the report *"The State of Aquatic Ecosystems on the Island of Newfoundland is an assessment of wadeable streams in Newfoundland using biomonitoring data for 2006-2019"*. Benthic macroinvertebrate communities were sampled from 93 sites following the CABIN protocol by different network partners. The collaborative nature of CABIN with its standardized protocol made it possible to compile comparable biomonitoring data across the island of Newfoundland.

Results indicate that the benthic macroinvertebrate communities varied by ecoregion across Newfoundland. Long-term trends at some reference sites suggest that benthic macroinvertebrate communities are shifting towards having more organisms known to be tolerant of organic pollution. The Atlantic Reference Model and other metrics detected differences between reference sites and sites exposed to a variety of human disturbances. The report also provides recommendations for future monitoring to fill some data gaps, and to better understand temporal variation, climate change impacts, co-located flow and temperature monitoring, and improved linkages with long-term water quality monitoring locations.



Cave and spring in Alberta

4 Groundwater

Groundwater is important to a wide range of activities and industries, including agriculture, fish farming, food processing, natural resource development such as oil and gas, mining, and forestry, as well as being crucial to ecosystem services. Groundwater directly supplies 30% of Canadians with potable water and contributes 40 to 60% of streamflow. As such, it is a cornerstone of the Canadian economy and is vital to the health and safety of Canadians. Collaborative relationships developed through work conducted under the *Canada Water Act* contribute to groundwater knowledge.

4.1 Natural Resources Canada Groundwater Studies

Overview

Natural Resources Canada (NRCan) continues to support federal government work in groundwater through various departmental branches, most notably the Geological Survey of Canada (GSC) through its Groundwater Geoscience Program (GGP) and Impact Assessment Division, the Canadian Centre for Earth Observation and Mapping, the Surveyor General, CanmetMINING, CanmetENERGY, and the Canadian Forest Service. The GSC also continued to participate in committees led by the Canada Water Agency.

A mandated responsibility for NRCan is the provision of technical expertise on groundwater in both Impact Assessments (IA) and Regional Cumulative Effects (CE) Assessments. In 2023–2024, NRCan completed the delivery of impact assessment requests related to groundwater quantity for 30

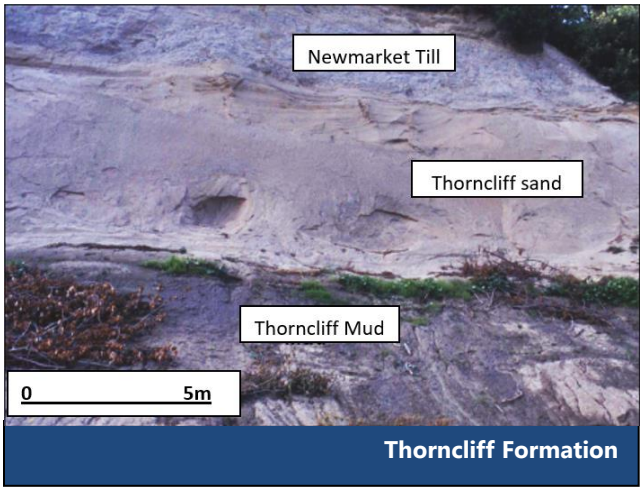
projects (18 ongoing and 12 new) at different stages of the assessment process from agencies such as the Impact Assessment Agency of Canada (IAAC), the Nunavut Impact Review Board (NIRB), and the Yukon Environmental and Socio-economic Assessment Board (YESAB). Groundwater expertise is required for most of these requests, reflecting the integrated groundwater–surface water system, impact on fish and fish habitat, human health, and upholding Indigenous rights. By contributing technical guidance, expertise, and data products, NRCan supports other Federal Authorities (e.g. Department of Fisheries and Oceans, ECCC, Health Canada, Statistics Canada etc.) in making informed regulatory decisions on freshwater and in preparing the Census of Environment Report.

The 2019–2024 funding cycle of NRCan's GGP concluded five projects under which aquifer characterization, methods development, Earth Observation (EO) and modelling were undertaken:

- Archetypal aquifers
- Fox Creek study
- Characterization and modelling of water resources,
- Groundwater Information Network
- Canada1Water

Final 2019–2024 NRCan presentations along with earlier science presentations are available online on YouTube at https://www.youtube.com/@groundwatergeoscienceprogr5559.

4.2 Aquifer and Aquitard Characterization



In 2023–2024, work continued on aquifer characterization, but with less emphasis on the 30 key Canadian aquifers identified in prior funding cycles, and more on regional and thematic initiatives. Two regional studies in southern Ontario have continued to refine understanding of aspects of the regional Oak Ridges Moraine (ORM) and southern Ontario setting. In the Greater Toronto Area (GTA), the Thorncliffe Formation is directly linked to the overlying ORM aquifer system (one of the previously identified key aquifers). The formation covers an area around 8,000 km^2 with a thickness about 50–100 m and has several prolific aquifers that have provided municipal groundwater supply to more than 200,000 residences and businesses for seventy years. This aquifer has potential for continued water supply and for Aquifer Thermal Energy System as demonstrated by a recent collaborative study with Toronto Region Conservation Authority and CanMet Energy.

Work was completed with the Ontario Geological Survey, the Ontario Oil, Gas and Salt Resources Library, and Aquanty Inc., to complete a full three-dimensional geological and hydrogeological framework for southern Ontario. The framework consists of four basin models, covering 110,000 km^2, for bedrock surficial geology, and hydrostratigraphy, which supported a fully coupled groundwater–surface water flow model for the region. The work is supported by publications on the geological data assembly, hydrostratigraphy, uncertainty assessment, and model implementation. It supports NRCan contribution to Annex 8 of the bilateral *Great Lakes Water Quality Agreement*. The regional framework models are being used for studies on potable water, carbon sequestration, hydrogen storage, petroleum exploration, and as a regional geological framework for the Nuclear Waste Management Organization.

Many Canadian aquifers are overlain by fine-grained sediments (e.g., glaciomarine mud) deposited in large bodies of water following ice sheet retreat at the end of the last ice age. Such fine-grained sediments are commonly aquitards (sediment that impedes vertical movement of groundwater) in hydrogeological systems and provide important protection to underlying aquifers from industrial, agricultural, and urban contaminants. Additionally, in Quebec and the Ottawa valley, such sediments are a further public safety concern as they are susceptible to landslides. In collaboration with the Rideau Valley Conservation Authority, the city of Ottawa, the University of Ottawa and l'Université du Québec à Montréal, work has investigated the geological history, properties, and pore water chemistry evolution of glaciomarine muds in the Ottawa area. The interdisciplinary investigation contributes to the development of methodologies and understanding of groundwater and mud aquitards as well as the hydrogeological character of sensitive glaciomarine muds (prone to landslides) and supports partner agencies roles in public safety.

The Fox Creek area in west-central Alberta, and the Paskapoo Formation aquifer, were studied as part of the Cumulative Environmental Effects Funding Initiative. The project assessed the impacts of 50 plus years of resource development (mainly oil and gas) on groundwater in a 700 km^2 watershed. In such a context, it is necessary to consider that contamination can originate either from the surface (potential incidents related to trucking and storage) or from deep geological units through upward fluid migration during hydraulic fracturing. This requires an improved understanding of the hydrogeological context, including the structural and lithological features that control groundwater flow, and information on groundwater recharge, age, geochemistry, etc. High yields in some wells, combined with the groundwater chemistry and age (typically more than 5,000 years), low-vertical recharge, and the presence of highly permeable, poorly consolidated sandstone channels, indicate that significant horizontal recharge is coming from the Rocky Mountain foothills.

These results imply that the aquifer is not very vulnerable in two respects: 1) groundwater is well protected from potential contamination by surface activities, and 2) climate change, at least over the next few centuries, will have little effect on available yields. No evidence of contaminants has been found in either surface or groundwater.

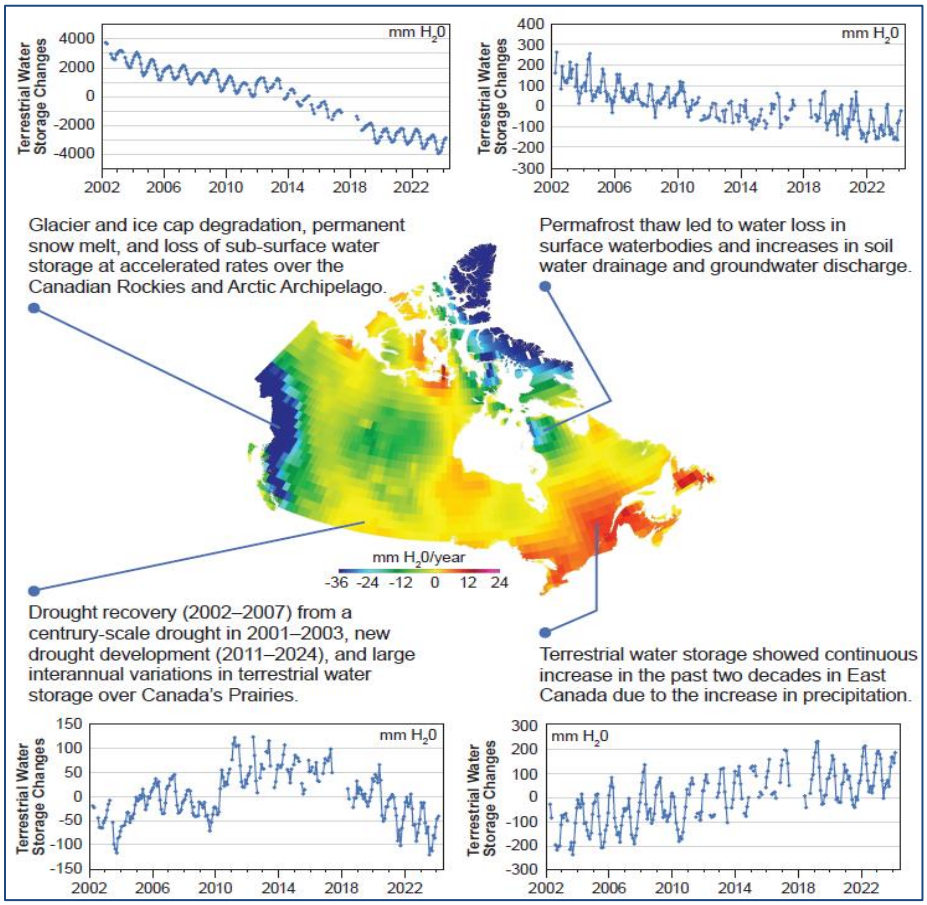
4.3 Groundwater Information Network

The Groundwater Information Network (GIN) continued to be used by Canadians in 2023–2024 as a point of access to integrated federal, provincial, and territorial groundwater data. Significant upgrades to technical and information content were made to a new online version of the system, expected to be released in 2024–2025. GIN also continued to interact with the Canada Water Agency on the National Freshwater Data Strategy and maintained international collaborations as well as integration with key international water data networks in the US and beyond. This culminated with the Canadian data contribution to the World Meteorological Organization (WMO) State of Global Water Resources report published in October 2023.

4.4 Gravity Recovery and Climate Experiment (GRACE)

The NASA Gravity Recovery and Climate Experiment (GRACE) satellite mission, which measures changes in Earth's mass, has been widely used to monitor variations in total water storage and to support groundwater storage modelling. GRACE signals are primarily influenced by large-scale tectonic activity, glacial isostatic adjustment (GIA), and fluctuations in total water storage (Figure 8). In Canada, GIA has been ongoing since deglaciation and remains a significant source of error in gravity signal corrections due to limited observational data. Refining regional models of GIA and tectonic activity, such as recent updates for eastern Canada, can enhance GRACE signal corrections and reduce uncertainties in water storage estimates. Additionally, efforts are underway to quantify long-term GRACE trend uncertainties. Improving the accuracy of GRACE corrections will minimize errors in decadal water storage estimates and prevent biases caused by erroneous adjustments.

Figure 8: Canada's terrestrial water Storage trends (2002–2022)



(Updated from Wang and Li 2016)

4.5 National Water Modelling – Canada1Water

The national water modelling project "Canada1Water" Phase 1 ended in March 2024 following three years of research and development and is fully documented in a report entitled *Canada1Water research and development Phase 1 report – Where Insight meets Foresight* and the Canada1Water data portal. This first phase of Canada1Water focused on the development of a national groundwater–surface water modelling framework to support decision making on water resource sustainability and support climate change adaptation challenges. During Phase 1, the project compiled, harmonized, and reclassified datasets for the full Canada1Water domain (Figure 9), including continental Canada, Baffin Island, and the Canada–USA transboundary watersheds. Initial results are for seven water basins (Figure 10) covering the model domain, with an example presented for the Pacific Drainage Basin (Figure 11).

Figure 9: Data inputs for development of modelling components for Canada1Water

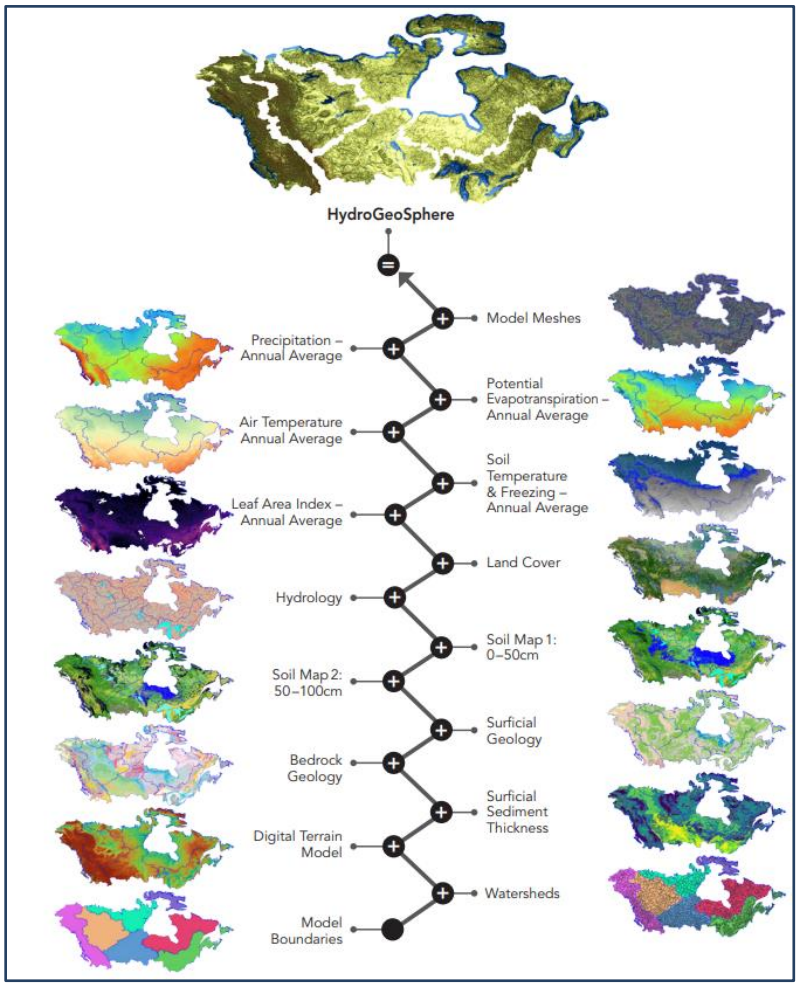


Figure 10: Seven water basin domains used for Phase 1

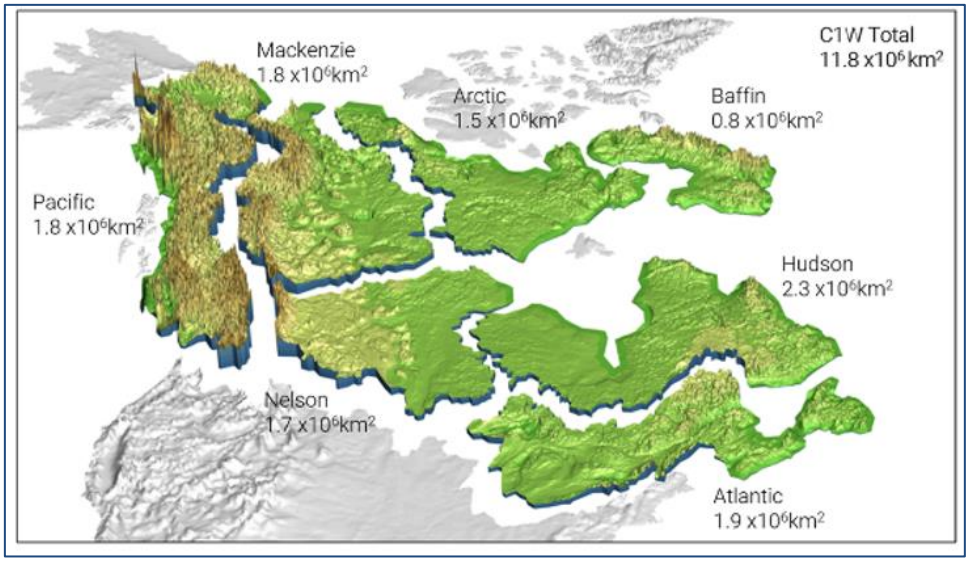
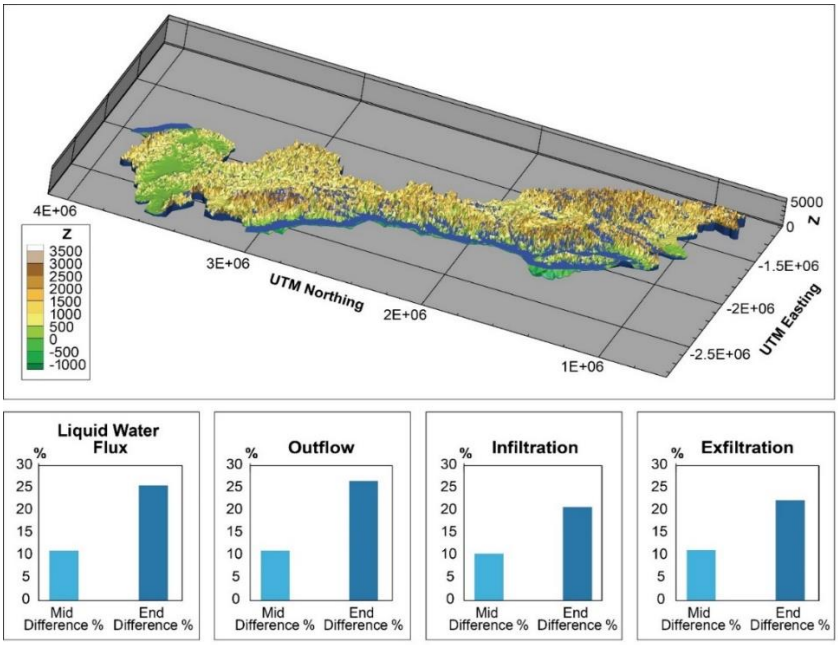


Figure 11: Pacific River Basin from Canada1Water modelling project



Notes: The Pacific region elevation model (top) shows the drainage area to the Pacific Ocean and variable relief of the basin. Beneath are four column graphs of changes in the terrestrial water balance at mid- and end-century, normalized to historic average. Changes at mid-century are around 9–11 percent for each of the four parameters presented. End-century change is greatest for precipitation (liquid flux) and stream outflow; whereas the influence on groundwater recharge and discharge is slightly lower.

While the seven water basins are very relevant for national-scale groundwater understanding, such regional projections do not always accurately reflect how localized areas will be impacted by climate change. Hence, aspects of climate change amplifying spatial and temporal variability in terrestrial hydrologic process are also being evaluated within Canada1Water. This includes 70 sub-drainage watersheds ranging from approximately 100,000 to 200,000 km^2 in area and collectively covering the seven major model domains. Results from analysis of these basins are being compared to terrestrial hydrologic monitoring data and remote sensing data, including from the GRACE satellite, to corroborate model-based estimates of spatial and temporal hydrologic variability.

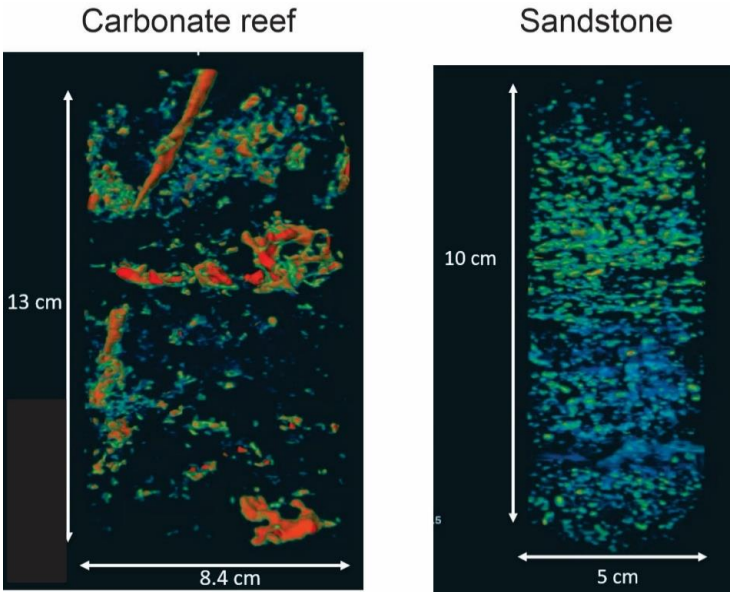
4.6 Methods Development

4.6.1 Geophysical techniques

Aquifer characterization is an ongoing challenge, particularly measurement of porosity properties. To aid characterization, methods have been developed to use medical computed tomography (CT) in the laboratory (Figure 12) and slim-hole nuclear magnetic resonance (MNR) at borehole field sites. The issue of scale across a variety of measurement techniques has been recognized as key to the interpretation of heterogeneous media, notably for porosity and pore network connectivity,

prompting more investigation into how to adequately characterize the pore scale spectrum. This has broad-ranging applications for hydrogeological studies of potable water aquifer assessment, contaminant migration, mineral exploration, geothermal storage, and carbon sequestration.

Figure 12: Visualization of 3D macropore networks in rock core segments



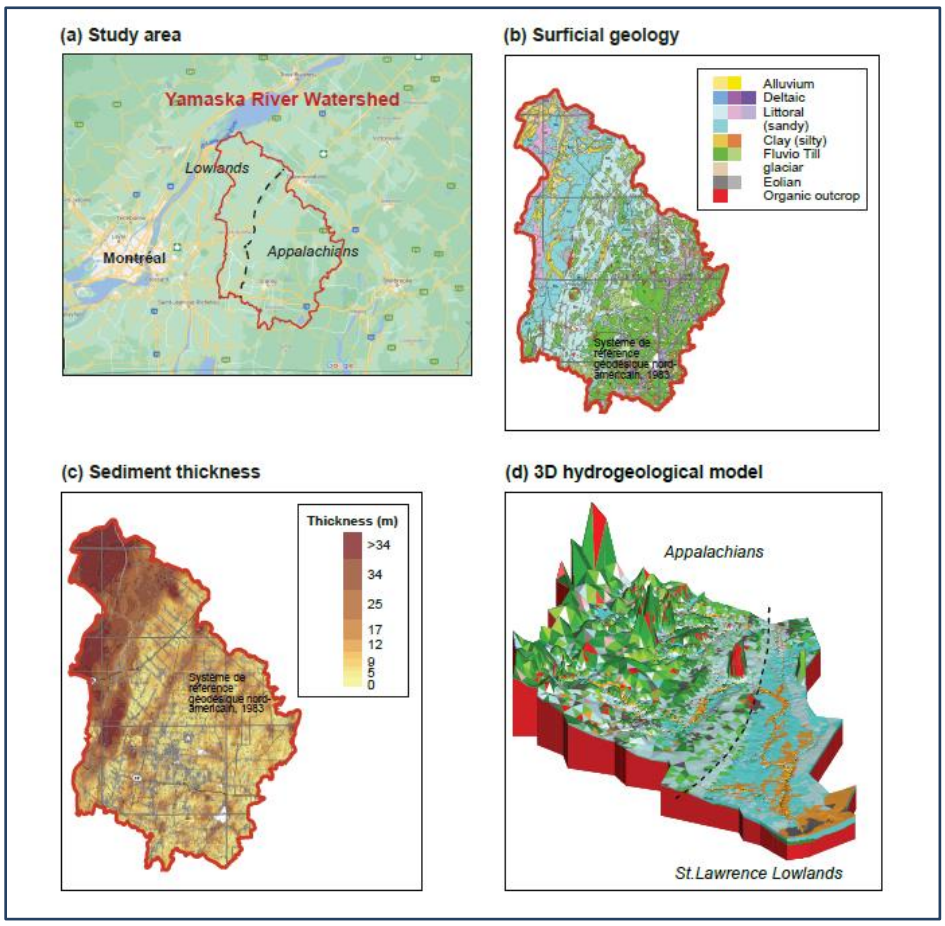
This illustration shows where water (coloured area) fills pores in two different aquifer types in southern Ontario. Red indicates high- and blue indicates low-water content. Pixel size is 63 microns.

This research continued in collaboration with the University of Guelph Morwick G360 Groundwater Research Institute, leveraging borehole facilities at the University and NRCan Bells corners site. The NRCan's GSC has operated a national downhole calibration site for the testing of geophysical tools for mineral exploration and groundwater studies for the past 40 years. An additional field laboratory focused on hydrogeophysical methods is active for the Vars-Winchester esker north of Embrun ON.

4.6.2 Watershed Modelling

Groundwater is critical to the sustainability of domestic and municipal water supply. Quantifying water cycle components limiting potable groundwater supply during low-flow (drought) periods can be difficult in many watersheds, and modelling changes in groundwater levels can be a challenge. Research in the Yamaska River watershed in the St. Lawrence Valley (Figure 13) continued to focus on methods development of a baseline reference physical groundwater-surface water model. The reference model was completed as part of a graduate thesis at the *Institut national de la recherche scientifique Centre Eau-Terre-Environnement* (INRS-ETE).

Figure 13: Yamaska watershed near Montreal

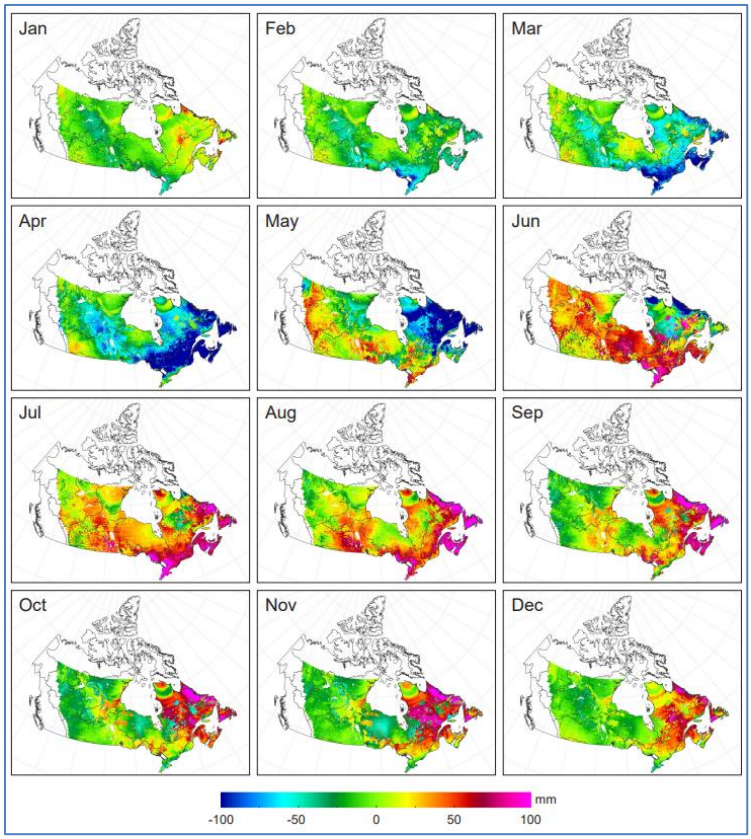


In addition, the development and validation of a new artificial intelligence-based (AI) algorithm for short-term water level projections has been completed. The reference model along with the AI projection algorithm will help enhance forecasts of groundwater recharge and low-flow conditions, particularly in relation to climate change for southern Quebec.

4.6.3 Earth Observation

National scale groundwater-surface water work is ongoing at NRCan's Canadian Centre for Earth Observation and Mapping (CCMEO) using Earth Observation datasets to refine estimates and support land surface modelling with Ecological Assimilation of Land and Climate Observations (EALCO). Recent work for the period of 2002–2016 using GRACE and EALCO has refined the seasonal groundwater signal. The groundwater trends over the 14-year study period present large spatial variability, with increasing trends of up to 10 mm/year average monthly groundwater change in eastern Canada and decreasing trends (similar magnitudes) in the west (Figure 14). Additional work is ongoing to estimate changes to surface water, of which groundwater has a considerable influence. Three methods have been compared for monthly surface water change, one is based on land surface runoff, and two using water-body water budgets. The two water budget approaches had the best performance and will be further improved using new Earth Observation (EO) data (e.g. the Surface Water and Ocean Topography (SWOT) satellite). The methods and outputs from this study can be used for calibrating and validating hydrological and climate models, assessing climate change and human disturbance impacts on regional water resources, and filling the water storage change data gaps in GRACE-based total water storage decompositions studies. Previous work on modelling the water balance closure of 370 Canadian watersheds is to be expanded to all of Canada in coming years.

Figure 14: The average monthly groundwater changes over 2003–2016, showing spatial and seasonal variations across Canada south of 65 degrees north



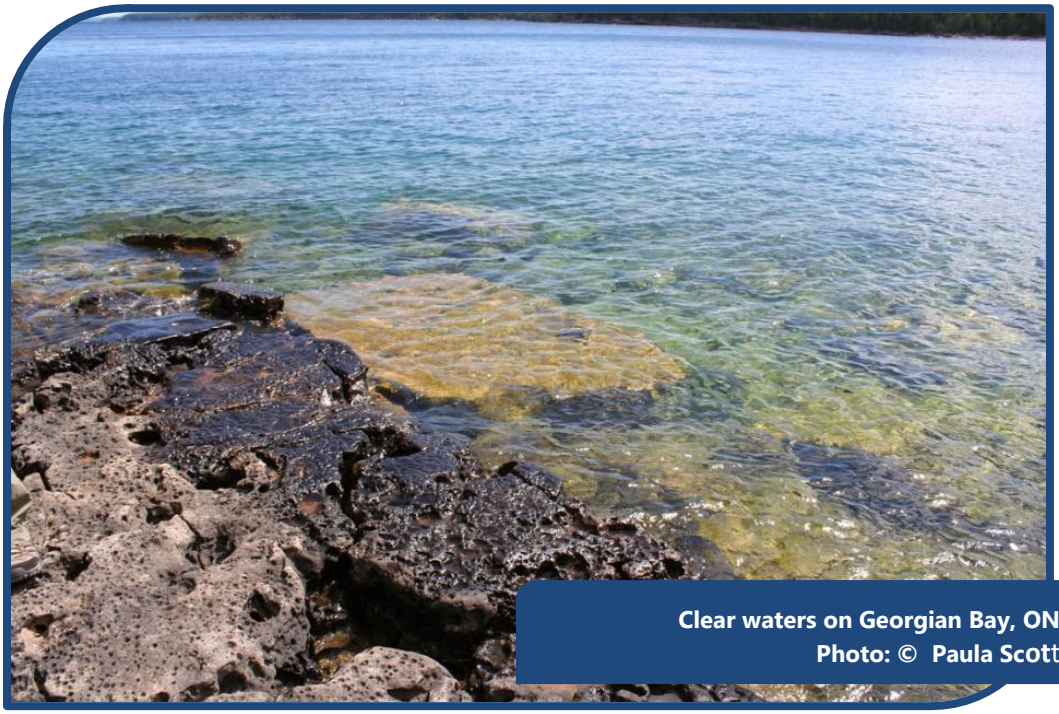
(From Li and Wang 2022)

4.7 Communication

Various forums have taken place in 2023–2024 in collaboration with provincial and territorial agencies, with an aim to exchange information, discuss issues, and plan joint activities:

- The 2023–2024 program review included consultations for the creation of the new Environmental Geoscience Program, which will also include groundwater-related work. A workshop was held with provincial, territorial, and other stakeholders to help guide the development of activities under the new Environmental Geosciences Program in late April 2023. Groundwater-related topics dominated the workshop, demonstrating the relevance and the need to continue federal government research in this field.
- An online workshop on groundwater issues in the Prairie Provinces and more generally in Western Canada was developed with the *Prairie Province Water Board Committee on Groundwater* (PPWB-COG) and held over two half-days in May 2023.
- The NRCan-led National Dialogue on Groundwater continued as a national quarterly online meeting of provincial, territorial, and federal groundwater experts, which typically attracts 30–40 attendees and fosters discussions between the different levels of government.

- The Ontario Groundwater Geoscience Open House is organized by the Ontario Geological Survey and supported by GSC and Conservation Ontario. In 2023–2024 it was held in Waterloo with registration similar to previous years (> 600 people) and physical attendance exceeding 200 people. The virtual attendance continues to grow beyond Ontario, with attendance from other provinces and internationally.
- GSC contributed to an International Joint Commission-funded gap analysis on groundwater and mining impact analysis for the Rainy River watershed and presented at the Rainy River Watershed Forum (International Falls, 2024).
- GSC has ongoing activities with three universities to promote groundwater education. It contributes to the Groundwater Project, an international initiative led by the University of Guelph to educate the next generation of hydrogeologists. It is working with the universities of Toronto and Waterloo and the Ontario Oil, Gas and Salt Resources Library to develop teaching aids, including 3D print models, augmented reality, and virtual reality visualizations for the communication of three-dimensional geological and hydrogeological datasets.



Clear waters on Georgian Bay, ON
Photo: © Paula Scott

5 Water quality management

This section describes several key cooperation-based ecosystem approaches through which ECCC and the Canada Water Agency work to ensure that Canadians have access to clean, safe, and healthy water, and that the country's water resources are used wisely, both economically and ecologically. While not all these initiatives are formalized under the *Canada Water Act*, they do contribute to the objectives of the Act through improving the management of water resources in Canada.

Led by the Canada Water Agency, the Freshwater Ecosystem Initiatives are cooperative, place-based approaches funded through the strengthened Freshwater Action Plan (2023) and are designed to respond to regional challenges and deliver environmental results in transboundary water bodies of national significance. The Canada Water Agency collaborates with a range of local partners and stakeholders that may include other federal departments (including ECCC, which leads freshwater scientific research), provinces and territories, regional, municipal, and local governments, Indigenous peoples, federal and state governments in the United States, academia and non-government organizations.

5.1 Lake Winnipeg Freshwater Ecosystem Initiative

Rock formation on Lake Winnipeg

The Lake Winnipeg Freshwater Ecosystem Initiative (Lake Winnipeg FEI) focuses on improving water quality and aquatic ecosystem health issues in Lake Winnipeg by supporting science and stakeholder-led actions. Some key program highlights from 2023–2024 include the following:

- investing $800,000 in seven stakeholder-led nutrient-focused projects;
- collaborating with Agriculture and Agri-Food Canada (AAFC) through a Letter of Agreement (LOA) to advance the understanding of the effectiveness of agricultural nutrient management practices in the Lake Winnipeg Basin; and,
- exploring opportunities, together with Manitoba, to enhance Indigenous participation in freshwater decision making through the Canada-Manitoba Memorandum of Understanding Respecting Lake Winnipeg and Lake Winnipeg Basin (Canada-Manitoba MOU); ECCC and Manitoba initiating dialogue with Indigenous partners.

Lake Winnipeg Basin Science Plan

Research carried out through this plan aims to improve knowledge of nutrient export to streams and understanding of the impacts of climate variability and invasive species on the lake. The science plan has four priority areas including reporting, monitoring to track changes, researching nutrient sources and lake ecosystem components. Some results for 2023–2024 include:

- assessing the spread and population status of invasive zebra mussels in Lake Winnipeg;
- quantifying sediment and nutrient loadings from the Red and Assiniboine River watersheds to Lake Winnipeg under historical climate and land management conditions using the calibrated Soil and Water Assessment Tool (SWAT) models;
- identifying critical source areas of phosphorus and nitrogen in the Red and Assiniboine River basins under historical climate and land management conditions;
- assessing the impact of climate change and beneficial management practices (BMPs) such as crop rotation, nutrient management, and wetland restoration on nutrient loadings in the Red and Assiniboine watersheds using the calibrated SWAT model; and,
- assessing the effectiveness of location-based BMPs on nutrient loadings in the South Tobacco Creek and Broughton Creek watersheds using the Integrated Modelling for Watershed Evaluation of BMPs (IMWEBs) model.

Efforts to reduce phosphorus amounts reaching Lake Winnipeg

Over the past seven years, the Lake Winnipeg Basin Program (now the Lake Winnipeg FEI) contributed over $11 million to support on-the-ground actions that reduce phosphorus loading, while also increasing public knowledge and engagement on water quality issues within the basin.

This includes activities such as:

- building retention ponds that intercept water flow across the landscape and capture nutrients;
- stabilizing riverbanks and lake shorelines;
- restoring wetlands; and,
- using natural infrastructure and innovative technologies to reduce nutrient loading.

2023–2024 was a transition year for the Lake Winnipeg FEI, with efforts focusing on sustaining key priorities and maintaining strategic partnerships, as new program authorities were finalized. Moving forward, the Lake Winnipeg FEI will build a framework to develop, test and implement a more targeted approach for reducing nutrient loading in the basin.

5.2 Great Lakes Freshwater Ecosystem Initiative

Lake Superior

The Great Lakes Freshwater Ecosystem Initiative (Great Lakes FEI) is Canada's primary regional program targeting federal water quality and aquatic ecosystem priorities in the Great Lakes. Through the Initiative, ECCC combines science and action to address the most significant threats to Great Lakes water quality and ecosystem health. Canada works in close collaboration with partners (e.g., U.S., Ontario) and stakeholders to advance Great Lakes restoration and protection primarily under two agreements: the *2012 Canada-US Great Lakes Water Quality Agreement* (GLWQA) and the *2021 Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health* (COA).

Restoring water quality and ecosystem health in Great Lakes Areas of Concern

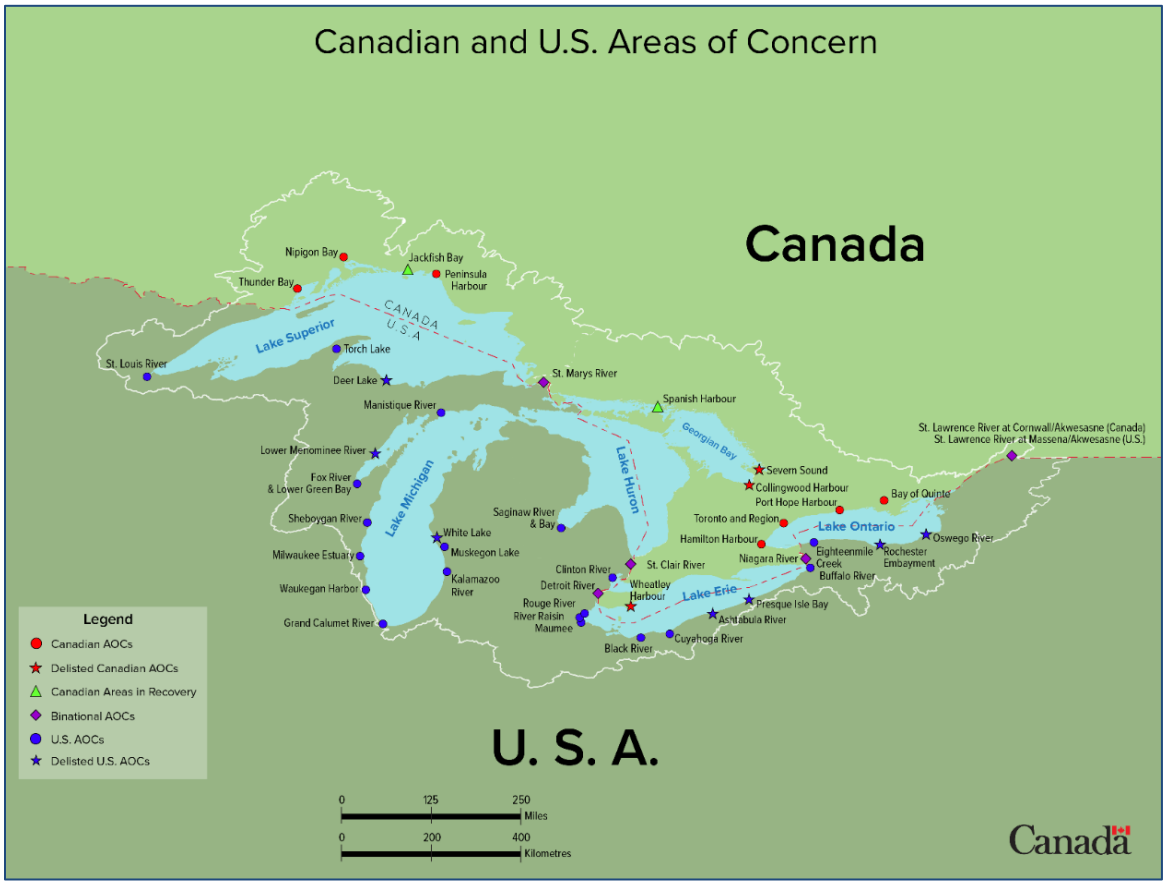
In March 2023, the Government of Canada announced a historic investment of $420 million over ten years in new resources for the Great Lakes FEI to accelerate implementation of Canada's commitments under the GLWQA.

Areas of Concern (AOCs) are specific locations, such as rivers, harbours, and embayments, where water quality and ecosystem health have been severely degraded by human activity at the local level.

New resources will target ambitious environmental results, such as completing the cleanup of all Canadian Areas of Concern by 2038 and achieving Canada's phosphorus load reduction targets for Lake Erie by 2038, by making progress on five priorities:

- restoring water quality and ecosystem health in Great Lakes AOCs;
- preventing toxic and nuisance algae;
- restoring and protecting critically important coastal areas including wetlands;
- reducing releases of harmful chemicals; and
- supporting community-based science.

Figure 15: Map of Canadian and United States Areas of Concern



In addition, the Great Lakes FEI includes dedicated funding to enhance First Nations and Métis capacity to implement on-the-ground actions to restore and protect water quality and ecosystem health, conduct science and monitoring to inform decision-making, and participate in governance.

Beneficial Use Impairments (BUIs) are the measures of the environmental, human health or economic impact of poor water quality.

Figure 16: List of the 14 BUIs identified in the *Great Lakes Water Quality Agreement*, 2012

1		Restrictions on fish and wildlife consumption
2		Tainting of fish and wildlife flavour
3		Degradation of fish and wildlife populations
4		Fish tumours or other deformities
5		Bird or animal deformities or reproductive problems
6		Degradation of benthos
7		Restrictions on dredging activities
8		Eutrophication or undesirable algae
9		Restrictions on drinking water consumption or taste and odour problems
10		Beach closings
11		Degradation of aesthetics
12		Added costs to agriculture or industry
13		Degradation of phytoplankton and zooplankton populations
14		Loss of fish and wildlife habitat

In all 17 AOCs, remedial action plans have led to improved environmental quality and ecosystem health. Of the 157 specific BUIs initially identified for remedial actions or further study across all AOCs, 100 have been addressed and the beneficial use restored. Efforts continue to restore and assess the remaining 57. To date, 69% of contaminated sediment has been managed in the AOCs where it contributes to impaired beneficial uses.

In 2023–2024, Canada, in cooperation with the Province of Ontario and many other partners, continued to restore beneficial uses in AOCs and confirmed that these three impairments had been restored:

- St. Lawrence River AOC at Cornwall/Akwesasne – Beach Closings
- St. Marys River AOC – Degradation of Fish and Wildlife Populations
- St. Clair River AOC – Restrictions on Drinking Water Consumption or Taste or Odour Problems

In 2023–2024, ECCC provided funding to several First Nations and the Métis Nation of Ontario to conduct community surveys to understand their Great Lakes fish consumption habits. Survey results will be used to inform actions to restore the Great Lakes Areas of Concern. Canada has also implemented 12 multi-year funding agreements with First Nations communities to support engagement in the development and implementation of remedial actions in Great Lakes AOCs and in lake-wide management decision-making processes.

In 2023–2024, Canada collaborated with the Province of Ontario and other partners to implement actions to restore water quality and ecosystem health in AOCs, such as:

- Hamilton Harbour AOC - Canada continued to lead the Randle Reef contaminated sediment management project into its third stage and begin covering the Engineered Containment Facility (ECF). This project will isolate more than 600,000 cubic metres of sediment contaminated with polycyclic aromatic hydrocarbons and heavy metals from the environment.

Randle Reef Contaminated Sediment Remediation Project – Multiple layers of environmental cap placement

- Niagara River AOC – Canada, Ontario and the Niagara Peninsula Conservation Authority sampled sediment, water and benthic organisms and conducted geotechnical studies along a stretch of Lyons Creek East, the last of 14 contaminated sediment sites on the Canadian side of this AOC. This work will be used to assess options to clean up the contaminated sediment.

- Port Hope Harbour AOC – Atomic Energy of Canada Limited continues to manage dredging to remove sediment contaminated with low level radioactive materials. Most of the contaminated sediment has been removed from the harbour and placed at the Port Hope Long Term Waste Management facility.

- Thunder Bay AOC – ECCC supported community partners to improve over two hectares of shoreline habitat along the Neebing-McIntyre floodway and the Kaministiqua River. The projects support the Thunder Bay Wildlife Habitat Strategy, a larger effort to restore riparian and coastal habitat in the AOC.

- St. Lawrence River AOC at Cornwall/Akwesasne – ECCC supported landowners to create fish and wildlife habitat and improve water quality by naturalizing more than four kilometres of shoreline.

- Toronto and Region AOC – The City of Toronto continued to implement its infrastructure program. Budgeted at over $3 billion and guided by the Wet Weather Flow Management Master Plan, the program supports the Remedial Action Plan goal to improve local water quality. Two projects nearing completion include the Coxwell Bypass Tunnel of the Don River and Central Waterfront project, and the Ashbridges Bay Treatment Plant Outfall project at Canada's largest municipal wastewater treatment plant. In addition, through the $1.35 billion Don Mouth Naturalization project, over 30 hectares of wetland and riparian habitat were created, achieving the habitat goals for the AOC.

Tunnel boring of the Ashbridges Bay Treatment Plant Outfall

Scientific research and monitoring

ECCC undertakes research, modelling and monitoring to support decision making in the Great Lakes. In 2023–2024, monitoring for nutrients, toxic chemicals, excessive and/or harmful algae, and other measures of water quality continued. Science activities focused on analysis and interpretation of data collected to investigate the factors contributing to excessive algal growth in the nearshore areas of lakes Erie and Ontario. Data and syntheses were used to improve and refine integrated watershed-lake models, and informed binational task teams who are assessing in-lake response of hypoxia and

algae to the changes in nutrient loads and measuring progress towards achieving objectives for Lake Erie.

Large scale validation of satellite-derived water quality information was carried out for North America's largest lakes, including the Great Lakes and Lake Winnipeg, reporting on water clarity status and trends in response to the cumulative effects of nutrient status, invasive species and hydrological events. In addition, Artificial Intelligence approaches were assessed for retrieving water quality information from satellite imagery in Lake Erie.

Ongoing reporting of algal bloom status and trends for Lake Erie using satellite-derived information continued along with assessments of climate and watershed drivers of bloom severity. An enhanced cloud-hosted web application was developed for distributing EOLakeWatch satellite-derived algal bloom products in near-real-time. This work was also conducted for Lake Winnipeg and Lake of the Woods.

Additional highlights of research efforts in 2023–2024 include:

- continued monitoring for water quality parameters in Hamilton Harbour;
- development of a three-dimensional physical and biogeochemical model of Hamilton Harbour to identify the impact of phosphorus reduction on improved water quality in the harbour;
- examination of nearshore and offshore primary productivity in Lake Ontario and evaluation of the influence of sinking and grazing on algal growth and biomass in nearshore and offshore areas;
- study of long-term and seasonal nitrate trends and potential prevention of large cyanobacterial biomass by sediment oxidation in Hamilton Harbour, Lake Ontario;
- study of spatio-temporal connectivity of the aquatic communities and association with cyanobacterial blooms from Thames River to Lake Erie;
- completion of some genetic sequencing of winter and spring planktonic communities from Lake Erie; and
- collaboration with American counterparts to characterize western basin cyanobacterial harmful algal blooms in Lake Erie at a high-resolution spatial scale.

ECCC continued collaborative research on identifying and understanding sources of groundwater contamination (including nutrients, road salt, and contaminants of emerging concern, like per- and polyfluoroalkyl substances [PFAS]) that threaten Great Lakes waters and their ecosystems. As part of this work, studies using artificial sweeteners and human-specific microbial markers are being used to estimate phosphorus loadings from domestic wastewater effluent from septic systems to tributaries in Lake Erie and Lake Simcoe basins. New research into septic system influences on antimicrobial resistance (AMR) in receiving streams is also being initiated.

Reducing the amount of phosphorus from reaching Lake Erie

ECCC is examining the effectiveness of phosphorus loading reduction targets in managing Lake Erie water quality, including the impacts of invasive species (e.g., mussels) on nutrient re-cycling and

decomposition of organic matter into lake sediment, to help provide insight into the long-term lake recovery. An integrated watershed and lake process-based model, using an ECCC model, is helping to advance this work.

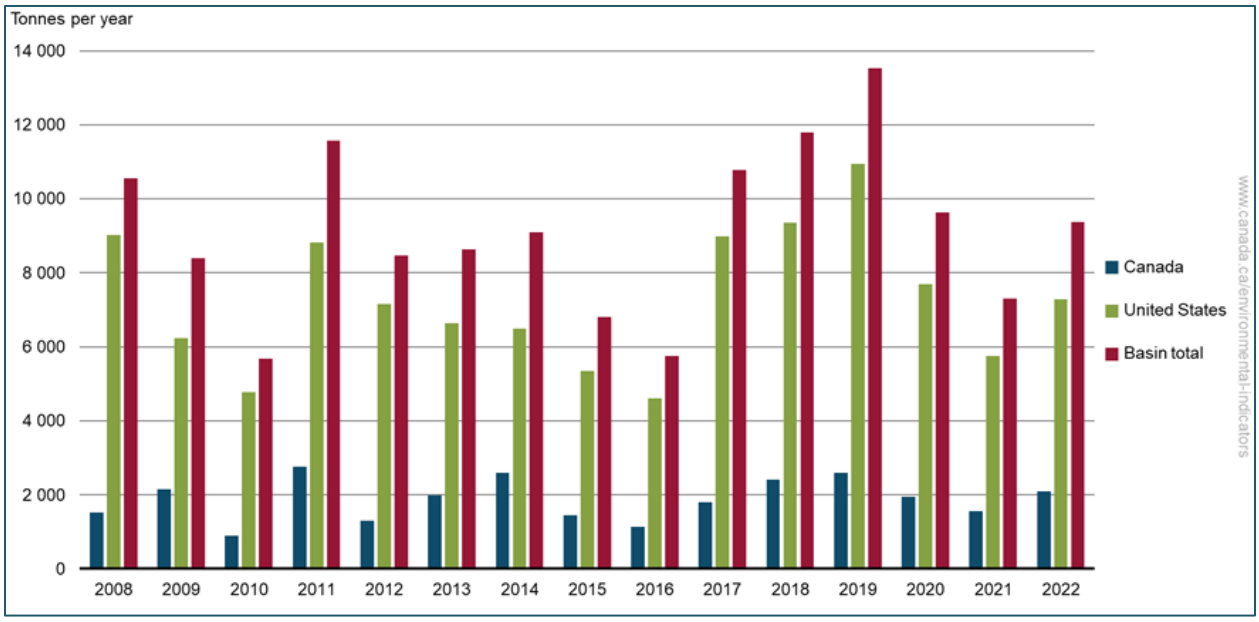
Researchers are assessing phosphorus interannual loading from sediments within Lake Erie, looking particularly at the sediment-water interface. Researchers are also assessing the responses of algal assemblages to variable nutrient pulse regimes associated with overall loading reduction.

CESI Indicator Spotlight: Phosphorus loading to Lake Erie

Through the Great Lakes FEI, ECCC provides funding for partner-led projects that increase participation in the application of phosphorus load reduction measures by promoting and demonstrating innovative approaches and best management practices.

The indicator Phosphorus loading to Lake Erie was updated in December 2023 with data up to 2022. Lake Erie phosphorus loads are publicly reported annually through various mechanisms.

Figure 17: Total estimated phosphorus loadings to Lake Erie, 2008–2022



Note: Basin total values include loadings from runoff and tributaries in Canada and the United States, flows from Lake Huron and atmospheric sources of phosphorus. Half of the total phosphorus loadings from atmospheric sources and half of those from Lake Huron were allocated to each country. For more information please visit the CESI indicator page.
Source: Environment and Climate Change Canada (2023) Canadian Environmental Sustainability Indicators Program.

5.3 St. Lawrence Action Plan

Since 1988, the Governments of Canada and Quebec have been collaborating through St. Lawrence Action Plan (SLAP), a comprehensive initiative aimed at conserving, restoring, protecting, and enhancing the St. Lawrence River. This partnership has been instrumental in addressing a range of

environmental challenges facing the river and its surrounding ecosystem, with both governments committing significant resources to ensure the health and sustainability of this vital waterway.

Over the years, the joint efforts under the St. Lawrence Action Plan have led to several notable achievements. One of the key successes has been the reduction of pollution entering the river, improving water quality and helping to preserve the diverse aquatic life that depends on it. Additionally, substantial work has been done to conserve, rehabilitate, and develop critical habitats for both animal and plant species.

The action plan has also prioritized the development of scientific knowledge and the enhancement of tools that empower decision-makers. Hence, SLAP helped provide a clearer understanding of the St. Lawrence's ecological challenges, thereby enabling more informed, effective decision-making to guide conservation efforts. Furthermore, the initiative has promoted sustainable practices in industries such as navigation, ensuring that economic activities along the river do not come at the expense of its ecological integrity.

The *Canada-Quebec Agreement on the St. Lawrence* (2011–2026), completed under the *Canada Water Act*, allows for implementation of the St. Lawrence Action Plan that covers a span of 15 years, with five-year planning cycles.

In 2023–2024, a factsheet related to the St. Lawrence Action Plan was published online: Physicochemical and Bacteriological Parameters of St. Lawrence River Water.

In 2024, the Overview of the State of the St. Lawrence was published. Various environmental indicators were used to measure the health of the St. Lawrence ecosystem. Analysis of eighteen indicators between 2018 and 2022 shows that 76% of them have either stayed the same or slightly improved.

In 2023–2024, work on projects identified in the *Canada Water Act* annual report for 2022–2023 continued, including:

- development and implementation of response plans for priority species,
- study of species targeted by sport and commercial fisheries in Quebec,
- measure of the recruitment index of Rainbow Smelt in Fjord du Saguenay,
- monitoring of summer sport fishing on the Saguenay,
- implementation of a discussion group on the management of ecological risks related to maritime transportation of oil and gas on the St. Lawrence,
- study of the synergistic effects of pesticides and cyanotoxins as stressors in Lake Saint-Pierre, and
- assessment of health risks pertaining to the microbial quality of bathing sites in the St. Lawrence River.

Community Involvement and Awareness

Through the Community Interactions Program (CIP), the SLAP financially supports the implementation of community-led projects aimed at conserving biodiversity, ensuring sustainable use, and improving the water quality and ecosystem of the St. Lawrence. In 2023–2024, ECCC distributed $432,1205 in funding for 12 selected projects.

The Areas of Prime Concern Program supports Stratégies Saint-Laurent and its 11 ZIP (Zones d'Intervention Prioritaire). committees. Through its financial contributions, the program encourages collaboration among various stakeholders working along the St. Lawrence River and fosters stronger engagement and partnership among communities, municipalities, organizations, and other stakeholders. These coordinated efforts empower local actors and raise their awareness of the environmental challenges faced by the St. Lawrence River.

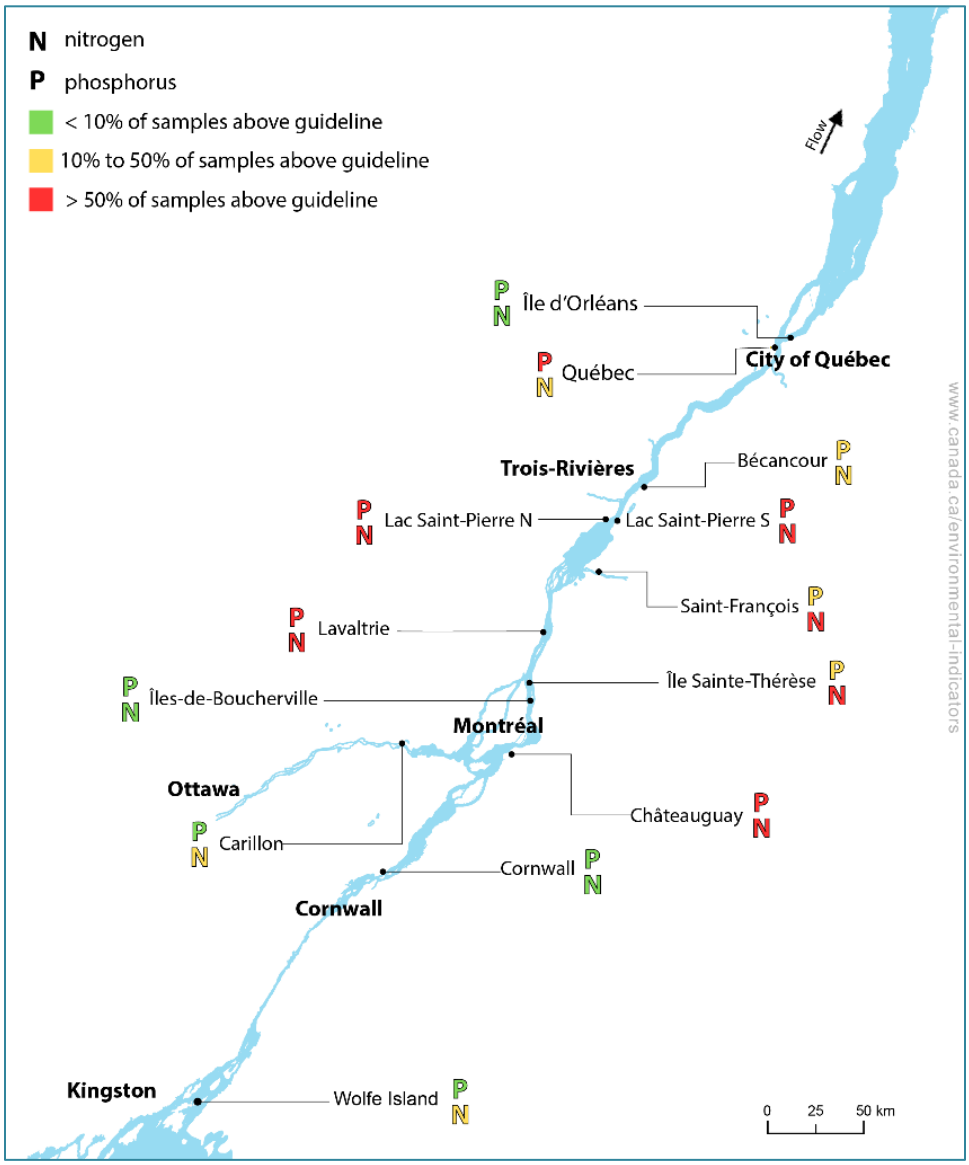
Scientific research and monitoring

Integrated modelling was initiated to study the causes and consequences of seasonal blooms in the lake and examine potential nutrient management strategies to improve water quality in Lake St. Pierre, part of the St Lawrence River system.

Researchers are developing a Soil and Water Assessment Tool (SWAT) model for the Lake St. Pierre watershed to support lake modelling and to assess the impact of best management practices (BMPs) on sediment and nutrient loading from surrounding tributary rivers of the lake.

CESI Indicator: Nutrients in the St. Lawrence River

Figure 18: Status of total phosphorus and total nitrogen concentration exceedances for the 2021–2023 period in the St. Lawrence River, Canada



Note: For the purposes of this indicator, the phosphorus guideline is 0.03 mg phosphorus/litre and the nitrogen guideline is 0.65 mg nitrogen/litre. For more details about the water quality guidelines and categories, please refer to the CESI indicator page.
Source: ECCC (2023).

5.4 Lake of the Woods Freshwater Ecosystem Initiative

Throughout 2023–2024, ECCC continued to implement key priorities for the lake, including monitoring water quality conditions, remote sensing of algal blooms, advancing the understanding of in-lake processes such as winter algal bloom conditions, and engaging with partners including Indigenous communities on nutrients and aquatic ecosystem health. ECCC engaged with Grand Council Treaty #3 (GCT#3) on the Anishinaabe Nation's Great Earth Law or Manito Aki Inakonigaawin and supported the GCT#3 community-based water quality monitoring program with technical advice and equipment enhancing their ability to participate in science and decision making. Some results of the Lake of the Woods science program for 2023–2024 include:

- Seasonal quantification of primary productivity (including under ice) in various embayments within the Lake of the Woods, with evaluations of the influence of underwater light climate.
- Assessing the impacts of climate change on sediment and nutrient loadings to the Lake of Woods from its contributing areas using the calibrated watershed model.
- Continuing the development of a high-resolution model in a priority sub-watershed for assessing the impact of best management practices on nutrient loadings to Rainy River.
- Reporting on the status, trends, and drivers of algal blooms on Lake of the Woods using satellite-derived bloom indices (2002–2021).

Lake Huron, ON

6 Research and development

Significant water-related research and development activities are conducted by ECCC across Canada. Many of them benefit from data gathered through monitoring activities conducted pursuant to hydrometric agreements concluded under the *Canada Water Act*.

6.1 Research on the impacts of climate change on aquatic systems and restoration of vulnerable wetlands

In 2023–2024, ECCC undertook a number of activities to understand, quantify, and predict local, regional, and national sensitivities of hydrological regimes and aquatic ecosystems to climate change, including:

- assessing hydro-climatic and ecological impacts of river ice jams and open-water floods with focus on the Peace-Athabasca Delta ecosystem and associated Environmental Flows and Hydrology objectives of the Wood Buffalo National Park Action Plan, including input towards the development of a Protocol for Strategic Flow Releases from the Peace River Canyon Dam (Site C Dam in the near future) to enhance recharge of delta wetlands;
- assessing impacts of climate variability/change and flow regulation/water abstraction on the flow regime of the Peace River, Athabasca River, Peace-Athabasca Delta ecosystem, and the Wood Buffalo National Park;

- assessing hydro-climatic, socioeconomic, and ecological impacts of ice processes and ice jams in the Saint John (Wolastoq) River, which affect many communities and species of aquatic life; and,
- conducting a study to model potential impacts of projected climate change (under different global warming levels) on hydrology and phosphorus loads for the Lake of the Woods watershed using Soil and Water Assessment Tool models.

6.2 Technology and program development within ECCC's NHS

NHS Renewal Initiative and the Innovation Component

The National Hydrological Service's Renewal Initiative was launched in the summer of 2018, with an $89.7M investment over five years (2018-2019 to 2022–2023), allocated to four areas or components: forecasting water quantity, infrastructure, rebuilding capacity, and innovation. The broad objective of the innovation component was to enhance monitoring and hydrological services by evaluating and testing innovations in measurement technology and data quality management. The innovation component had a budget of $15.5M, 21 full-time equivalent (FTE) positions, and was later extended by a year due to the impact of the COVID-19 pandemic.

In 2023–2024, the focus of the innovation component remained on the following areas:

- improving the timeliness of hydrometric data production through improved workflows and management of data from the field;
- improving products and services delivered through Wateroffice and other means such as Datamart and Geomet;
- working towards publication of a site characterization database;
- improving data computation methods for winter records;
- improving the accuracy and reliability of water level data by improving quality control and use of non-contact measurement methods;
- investigating the incorporation of uncertainty into hydrometric data products;
- standardizing the vertical reference for all NHS hydrometric stations;
- bringing further improvements to the NHS data production system;
- investing in means to improve resiliency of telemetry systems;
- looking at additional methods to improve the estimation of river discharge; and
- testing the use of non-contact technology, such as surface velocity radars and cameras (using images from both drones and fixed station cameras) for improved water level and flow monitoring.

The innovation component of the NHS Renewal Initiative was completed by March 2024, at which time the project closeout process was initiated.

Hydrometric instrumentation, data collection and data production

In 2023–2024, ECCC continued its work as follows:

- investment at the operational level in field technologies, including hydroacoustic equipment and advanced deployment platforms, such as bank-operated cableway systems and remote-control boats as manned cableways across the country are being decommissioned;
- increased testing of routine quality assurance for hydroacoustic devices (both field- and laboratory-based) and planning for a national approach to centralized procurement and routine testing of all hydrometric sensors;
- development of in-house tow tank capacity for routine validation testing of acoustic Doppler velocimeters (ADVs), which is the device that accounts for more than 60% of all discharge measurements across Canada;
- operation of more than 90 transmitting cameras and more than 200 lower-cost time-lapse cameras through ECCC's NHS (including predominately satellite cameras and a handful of cell modem cameras);
- examination of ways to support information management and dissemination plans for station images to minimize the risk of inadvertently capturing personal information; and
- transition from land-based telecommunications systems to cellular or satellite services in coordination with territorial and provincial partners, keeping abreast of emerging satellite telemetry technologies and coordinating risk analysis with other Canadian environmental monitoring agencies through an interagency telemetry working group.

Surface Water and Ocean Topography Mission

In 2023–2024, ECCC continued work related to the application of space-based technologies for water resources monitoring in Canada, through participation in the Surface Water and Ocean Topography (SWOT) Mission satellite mission. SWOT is a joint mission between the National Aeronautics and Space Administration (NASA) and Centre National d'Etudes Spatiales, with support from the Canadian Space Agency (CSA) and United Kingdom Space Agency. SWOT includes novel radar altimetry technology designed to provide the first global survey of the Earth's freshwater. Canadian SWOT team members made significant progress on several fronts, including operation of calibration and validation field test sites, assessment of initial SWOT data obtained from its first year of operation, and development of SWOT data applications, among others. ECCC scientists and engineers also participated on both Canadian and international SWOT working groups and committees and collaborated with academic researchers from Canadian and U.S. universities on SWOT-related research projects.

Quality assurance

ECCC continued its commitment to quality assurance and continual improvement in 2023–2024. Efforts to increase education and awareness among staff on standard field and office practices and procedures were a continued priority in 2023–2024. These online all-staff awareness sessions are one

way to enhance quality assurance throughout the program, nationalizing and standardizing our approach to data collection and analysis.

In fall 2023, ECCC completed an International Standards Organization Quality Management System (ISO 9001) external recertification audit as part of maintaining certification in the globally recognized standard. ECCC also completed its internal Quality Assurance Program audits in all the operational hydrometric monitoring regions of the program. These audits, which examine whether procedures have been followed during both field and office operations, identify any deficiencies and make recommendations for corrective actions to drive improvement. The audit procedure was made more efficient using online tools, enabling the audit of many more hydrometric stations than in years past.

The update of standard operating procedures for field staff is an on-going activity that is informed by technological advances, knowledge gaps, and findings from internal audits. This year the procedures on water level measurement were updated with clearer language and guidance in response to findings from the quality assurance program audit the previous year. Similarly, the national procedures on levelling were also updated based on three years of feedback from staff and Quality Assurance Program audits.

New standard operating procedures were developed to address gaps identified in our existing documentation. This year saw the development of standard procedures for managing beaver activity that affects hydrometric station operations. It also saw the development of NHS's first standard operating procedure on operating stations with rated weirs, which are structures sometimes used to monitor flow in areas with persistent low flow (less than approximately $2m^3/s$). Research and investments continued to improve our methods for estimating discharge when the gauging location is impacted by variable backwater due to weed growth or the presence of ice.

Hydrometric science and development

ECCC continued to collaborate among other internal ECCC groups as well as with external government and academic partners to improve flow and water level prediction capabilities under the auspices of its federal obligations related to transboundary water management, and through provision of hydrologic prediction products and services in collaboration with provincial and territorial partners and their flood forecasting operations, building off the recent successes of the Renewal Initiative. Operationalization of hydrodynamic and ecohydraulic models in rivers of federal significance also continued through collaborations with key academic partners. NHS continued efforts with academia, industry, and provincial and territorial partners to continue updates to the "Modélisation Environnementale communautaire - Surface Hydrology" (MESH) model and is working with these groups to ensure ECCC modelling tools and its data services are compatible within their operating environments for flow forecasting.

ECCC also continued outreach and engagement efforts with operational practitioners from the provincial and territorial river forecasting centres and worked with other ECCC groups to provide

products and services in support of their flood forecasting and early warning activities. ECCC and its provincial and territorial partners continued to actively participate in the "Community of Practice on Operational Hydrological Prediction in Canada", which was established in the fall of 2021. The community held its first face-to-face workshop during February 2024, to discuss priorities, identify shared needs, projects of interest, and opportunities for collaboration among practitioners. The Community also met virtually every three months during the past year and informally in between meetings, encouraging interactions, collective learning, inter-jurisdictional support, and collaboration among its members. Collectively, this will help build relationships and strengthen collaboration between the river forecasting centres and ECCC and ensure ongoing prediction research and development efforts are aligned with the needs and requirements of end-users. ECCC's end-of-year survey of Community members indicated they value the opportunity to connect with other flow forecasting practitioners from other regions across the country and saw value in maintaining the initiative.

ECCC also continued developing and enhancing its water quantity prediction capacity. The National Surface and River Prediction System (NSRPS), an integrated atmospheric, land surface and streamflow prediction system was successfully delivered to operations with experimental status in the fall of 2021. The system was developed by research hydrologists and physical scientists from ECCC's Meteorological Research and Development and the Canadian Centre for Meteorological and Environmental Prediction (CCMEP). Flow predictions from this system continue to be extended into additional basins, including the Fraser River which was added this past year, bringing the total basin coverage to 10 (includes the previously implemented Yukon, Mackenzie, Skeena, Columbia, Nelson, and Churchill rivers, the Great Lakes–St. Lawrence River Basin, the terrain draining into the Gulf of St. Lawrence and the Bay of Fundy Basin). These products are now available and disseminated to provincial and territorial partners to support them in their operational forecasting operations. ECCC also continued to support provincial and territorial forecasting centres in conducting preliminary evaluations and assisted them in integrating NSRPS products into their operational systems.

ECCC's support of a community-based version of the NSRPS via MESH is facilitated through a framework that allows the Department to continue efforts at maintaining and providing updated versions of its operational land surface and flow modelling systems to academic partners. These partners include the Université Laval, Université de Sherbrooke, McMaster University, University of Saskatchewan, University of Calgary and University of Alberta, allowing for continued mutually beneficial innovation. In 2022–2023, ECCC moved the code of MESH to an external project management platform to improve coordination of collaboration with academia and other partners. In 2023–2024, it expanded these efforts to use project planning and management tools available by GitHub and the migration of its documentation to a Confluence platform. ECCC has also worked with the Canadian Centre for Climate Modelling and Analysis (CCCma, under the Climate Research Division) to provide the latest climate change model enhancements from the land-surface system from the Canadian Earth System Model for hydrological applications using MESH. Taking advantage of CCCma's improvements to carbon and nitrogen cycle representations in land-surface models will allow academic and internal/external partners to improve science-based modelling of streamflow

and other hydrological variables for climate change impact evaluations. Lastly, NHS has continued to support the operational application of MESH for the Saskatchewan and Yukon governments, as well as continuing to expand its capabilities within the Flood Early Warning System.

ECCC and provincial and territorial partners also continued to evaluate and integrate products from the Canadian Surface Reanalysis (CaSR, previously known as the Regional Deterministic Reforecasting/Reanalysis System), a re-analysis covering the period 1980–2018 for North America. CaSR provides a source of continuous historical data describing the main meteorological variables required for land surface and hydrology applications, such as near-surface air temperature and precipitation. Further innovations to CaSR continued during 2023–2024, including the development of new CaSR-Land and CaSR-Rivers systems and products, which will build on the previous reanalysis by providing a high-resolution historical reanalysis of land-surface and hydrologic flow conditions across Canada. Finally, CCMEP has developed value-added statistical products computed from CaSR, CaSR-Land, and CaSR-Rivers, which include watershed-average statistics computed from the recently updated NHS Reference Hydrometric Network Basin Polygons.

Outreach

ECCC supports openness and interoperability of information and data access across multiple systems. To enhance data dissemination quality, ECCC now provides data descriptors alongside real-time water level and discharge data, quality assurance levels, rating models for discharge estimation, and uncertainty metrics, along with field visit information. ECCC also issued a pre-release of the national hydrometric basin delineation dataset, enabling users to download it. Additionally, a new feature was introduced on the Wateroffice map page to display the basin delineation polygons. The "Contact Us" page was redesigned with links from multiple locations across the Wateroffice website to attract more inquiries and to better track, respond, monitor, report on and archive the interactions with hydrometric data users.

6.3 Modelling and studies

Regional hydrometeorological modelling can help improve water resources management. Researchers and scientists at ECCC and many partner organizations use atmospheric and weather data as input for day-to-day operational forecasting models, and hydrologic data collected under the hydrometric agreements concluded under the *Canada Water Act* as input for hydrologic models.

Great Lakes

ECCC collaborates with the United States Army Corps of Engineers (USACE), the National Oceanographic and Atmospheric Administration (NOAA), and the United States Geological Survey (USGS) to operationalize various modelling systems for historical analysis and future predictions of the water balance in the Great Lakes – St. Lawrence River system.

In 2023–2024, ECCC continued to improve methods for coupled hydrometeorological modelling and prediction systems under an expanded environmental prediction framework. These efforts enable an improved understanding of interactions between the atmosphere, land surface, basin stream network and the Great Lakes themselves, and support ongoing critical monitoring, multiple forecasting initiatives, and overall improved water management activities in the region. Highlights during the past year include the development of a coordinated long-term dataset of hydroclimate parameters from a statistical model based on model results from various agencies. These products have also been evaluated for use in operational Great Lakes forecasting, adaptive management efforts, and to support communications within the basin.

Methods for using a combination of the ECCC Canadian Precipitation Analysis (CaPA)-based products and various NOAA precipitation analyses to replace the currently coordinated precipitation product also continue to be evaluated. Efforts to operationalize the bi-nationally merged product are ongoing on both sides of the border.

Verification analysis of past measurements continued. ECCC efforts continued to ensure quality assurance and Canada-U.S. coordination of connecting channels hydrometric station measurements. Measurement accuracy of Great Lake connecting channel flows continue to support development of water balance prediction models and accounting for binational water use.

6.4 International rivers

The International St. Mary and Milk River Study commenced on November 10th, 2021 and moved into its third year during fiscal year 2023–2024. The Study seeks to establish options for improving access to the shared waters, which would include administrative and structural options.
The Study is focusing on two key areas:

- The water measurement data and calculations currently used to determine the amount of water that each country receives.
- Possible options to improve how water is conveyed within the basin. This could include a review of infrastructure such as canals and reservoirs that could improve both countries' access to water shared under the 1909 Boundary Waters Treaty and the 1921 International Joint Commission (IJC) Order of Approval.

ECCC contributions focused upon advancing the technical work of the study and continuing to engage with the Public Advisory Group and the Indigenous Advisory Group.

In addition, ECCC's work continued as part of the Great Lakes–St. Lawrence River Adaptive Management (GLAM) Committee, which monitors the performance of the plans for regulating outflows from Lake Superior into Lake Michigan-Huron via the control structures in the St. Mary's River, and outflows from Lake Ontario via the control structures in the St. Lawrence River. During

2023–2024, the GLAM Committee made considerable progress on Phase 2 of the Expedited Review (ER) of Plan 2014, which is the regulation plan for Lake Ontario and the St. Lawrence River consisting of rules on water releases at the Moses-Saunders Power Dam. The ER was requested by the IJC following the extreme high-water levels in 2017 and 2019 throughout the Great Lakes Basin. The intent of the ER of Plan 2014 is to assess whether there are possible modifications that can be made to improve outcomes in the system.

6.5 Global

ECCC continued to support hydrology programs within the World Meteorological Organization (WMO) in 2023–2024. In Fall 2023, the WMO Secretariat hosted a technical webinar for members of Regional Association (RA) III (South America) and RA IV (North America, Central America, and the Caribbean). The webinar was initiated and led by ECCC with presentations by experts from ECCC's NHS and the USGS covering a variety of hydrology- and hydraulic-related topics. Following the expression of interest from members for future webinars covering both general and targeted topics, ECCC developed a survey for WMO to gain feedback and information on topics of interest for future events. Based on the results of the survey, ECCC and the USGS are jointly planning a follow-up webinar series planned for 2024–2025. The survey suggests the webinars were successful at sharing and promoting best practices with less-developed national hydrological services in both regions.

In 2023–2024, ECCC contributed to the 2nd annual "Status of Global Water Resources"[6] WMO publication. The annual report is a commitment of the WMO to the United Nations 2023 Water Conference Water Action Agenda, presenting an independent assessment of the state and trends (relative to long term averages) of the hydrological cycle components (surface water, groundwater, soil moisture, snow cover, glacial mass, and water vapor). Canada provided data, technical advice, and review capacity and will continue to support the publication in future years with increased data offerings and products.

In 2023–2024, ECCC continued a long-standing commitment to collaborations with Nordic and other national hydrologic services through the International Hydrometry Group. This group investigates and shares information on technical hydrometric program infrastructure challenges and solutions to promote hydrometric science globally.

The WMO also initiated a pilot program for centennial hydrologic stations in 2022. The recognition of centennial stations globally will result in a strong reliable global data set for climate change science and will also contribute to sustaining networks. Following on the success of the pilot program in 2022, in 2023-24 the WMO Secretariat requested additional centennial station

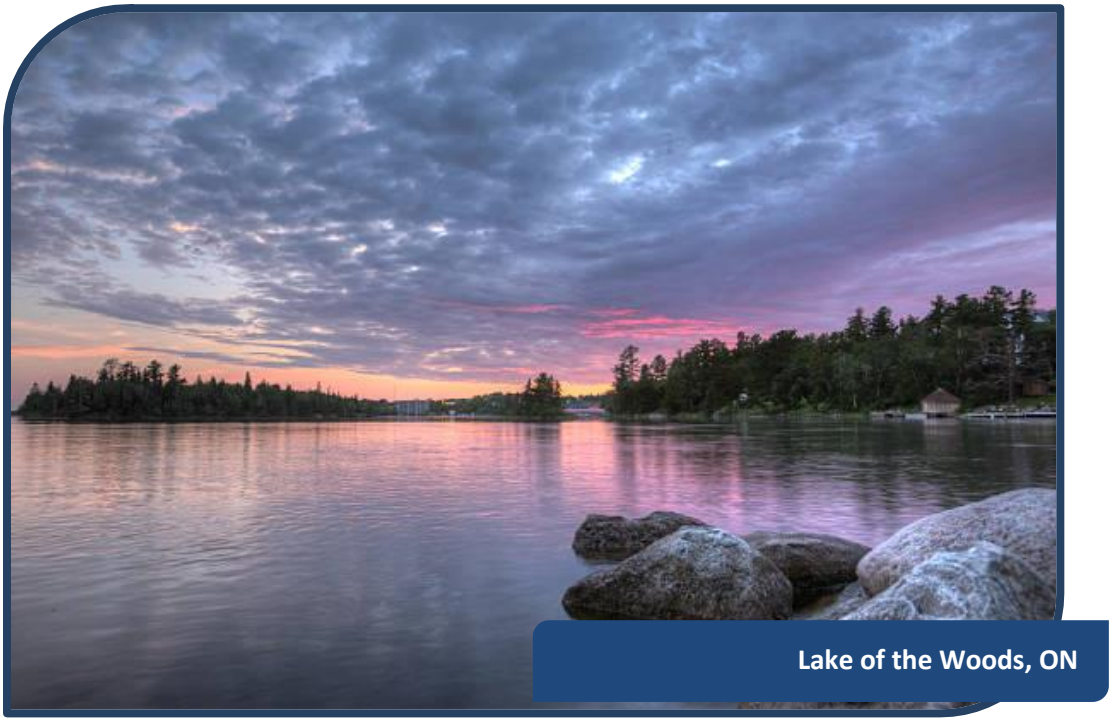
[6] https://library.wmo.int/records/item/68473-state-of-global-water-resources-report-2022

nominations from Members. Canada nominated four additional stations which meet strict criteria (length of record, data continuity, metadata availability, and operational consistency):

- 05OC001 Red River at Emerson
- 08NA002 Columbia River at Nicholson
- 08MF005 Fraser River at Hope
- 05DF001 North Saskatchewan River at Edmonton

As of March 2024, these stations were being assessed by the WMO Secretariat. If they are accepted into the Centennial Station Recognition Program, they will bring the total number of WMO centennial hydrometric stations in Canada to seven (7) joining the previously accepted stations:

- 05BB001 Bow River at Banff
- 01EO001 St. Mary's at Stillwater
- 04LJ001 Missinaibi at Mattice



Lake of the Woods, ON

7 Inter-jurisdictional water boards

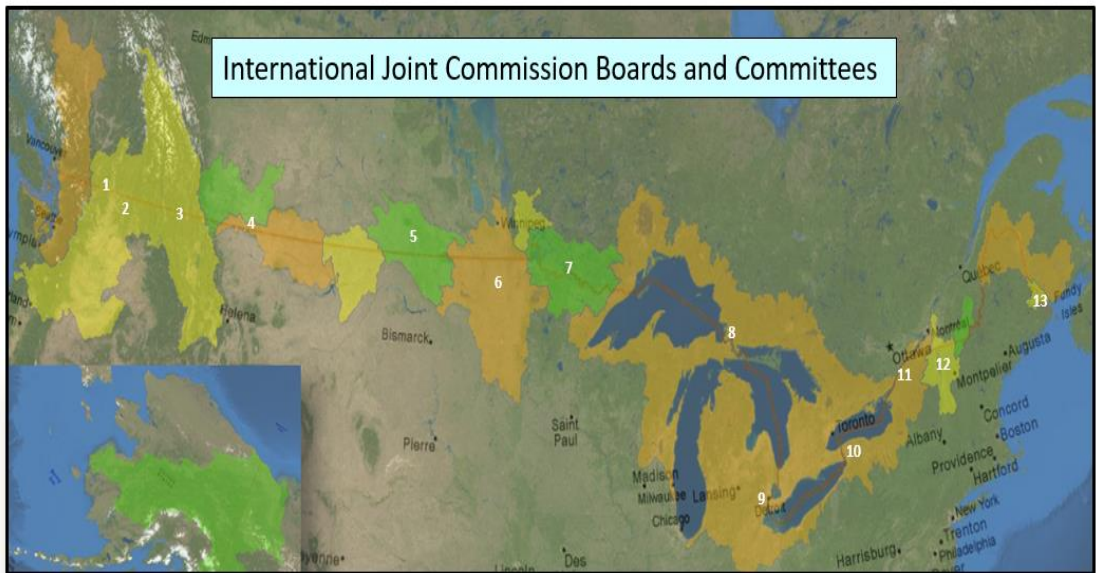
Domestic

Domestic inter-jurisdictional water boards have been established to focus on specific water issues that have implications for more than one province or territory. Information such as annual reports, board activities, maps, water level forecasting, and water management agreements can be found at each board's website: the Mackenzie River Basin Board (MRBB), the Prairie Provinces Water Board (PPWB), the Lake of the Woods Control Board (LWCB) and the Ottawa River Regulation Planning Board (ORRPB). Apart from the LWCB, each of these boards was created under the authority of the *Canada Water Act*.

International

Canada and the United States cooperate to manage joint waters through the International Joint Commission (IJC). The IJC leads most of international transboundary and inter-jurisdictional water boards in which Canada participates. While the work of the IJC is not pursuant to the *Canada Water Act*, ECCC reports on progress under the *Environment and Climate Change Canada-International Joint Commission Memorandum of Understanding*.

Figure 19: Areas covered by International Joint Commissions Boards and Committees



1. International Osoyoos Lake Board of Control
2. International Columbia River Board of Control
3. International Kootenay Board of Control
4. Accredited Officers of the St. Mary-Milk River Board
5. International Souris River Board
6. International Red River Watershed Board
7. International Rainy-Lake of the Woods Watershed Board and Water Level Committee
8. International Lake Superior Board of Control
9. Great Lakes – St. Lawrence Adaptive Management Committee, plus the Great Lakes Water Quality and Science Advisory Boards
10. International Niagara Board of Control
11. International Lake Ontario – St. Lawrence River Board
12. International Lake Champlain-Richelieu River Study Board
13. International St. Croix River Watershed Board

8 Water data online

The Government of Canada's Water website provides content on ECCC's water-related activities and program areas as well as general information on a wide range of water-related topics and the full text of key water publications (such as the *Great Lakes-St. Lawrence River water levels*). In addition, the site provides links to laws and regulations.

ECCC's Wateroffice website provides public access to real-time and archived hydrometric data collected in Canada.

ECCC's Meteorological Services of Canada Datamart provides access to weather, climate and water data as static files using open file formats.

ECCC's Canadian Environmental Sustainability Indicators (CESI) program provides data and information to track Canada's performance on key environmental sustainability issues including climate change and air quality, water quality and availability, and protecting nature. The environmental indicators are based on objective and comprehensive information and convey environmental trends in a straightforward and transparent manner. CESI provides this data on two platforms:

- The Canadian Environmental Sustainability Indicators website
- CESI's mapping application

ECCC's EOLakeWatch provides access to near real-time satellite observations of inland water algal blooms, with links to annual summary reports of algal bloom conditions on priority Canadian lakes.

Federal Water Quality Monitoring and Surveillance data are available through various mechanisms:

1) Freshwater quality data collections on the Government of Canada Open Data Portal:

National scope

- National Long-term Water Quality Monitoring Data
- Automated Fresh Water Quality Monitoring and Surveillance Data
- CABIN Canadian Aquatic Biomonitoring Network

Regional scope

- Great Lakes Water Quality Monitoring and Aquatic Ecosystem Health Data
- Surface Water Quality and Benthic Invertebrates, Oil Sands Region
- Freshwater Quality Surveillance Data – Pacific Basin
- Field data for the mapping of wetlands of the St. Lawrence River between Cornwall and Trois-Pistoles, Lake St. Pierre wetlands and Boucherville Islands area.
- Clean Air Regulatory Agenda Freshwater Inventory and Surveillance of Mercury (CARA FISHg)
- Great Lakes Fish Contaminants Monitoring and Surveillance Data

2) Two interactive websites allow for location and parameter-specific search and download of ECCC freshwater quality monitoring and surveillance data for specific regions:

- Envirodat-PYR Web data extraction – provides data for the Pacific and Yukon watershed
- Fresh Water Quality Monitoring and Surveillance web mapping – provides data for the Great Lakes, St. Lawrence and Atlantic watersheds

3) The Gordon Foundation's DataStream integrates federal datasets with community-based water quality monitoring data. ECCC has provided technical advice and expertise (with respect to water quality data) to support the expansion of and improvements in the platforms for Lake Winnipeg DataStream, Mackenzie DataStream, Atlantic DataStream and the Great Lakes DataStream.

9 Additional information

To obtain further information or publications and to submit questions or comments concerning the *Canada Water Act*, please contact ECCC's Inquiry Centre.

Environment and Climate Change Canada
Public Inquiries Centre
Place Vincent Massey Building
351 Saint-Joseph Boulevard
Gatineau QC K1A 0H3
Telephone: 819-938-3860
Toll Free: 1-800-668-6767 (in Canada only)
Email: enviroinfo@ec.gc.ca

The following media relations contact is also available to provide information.

Environment and Climate Change Canada
Media Relations
Toll-free within Canada: 1-888-908-8008
Outside Canada: 1-819-934-8008
Email: media@ec.gc.ca