Water Quantity in Canadian Rivers

Canadian Environmental Sustainability Indicators

Environment and Climate Change Canada
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Canada

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Water quantity in Canadian rivers

Canada is a water-rich country. However, surface water quantity varies greatly over time and space; this variation has major impacts on people's lives. Too much or too little water can lead to serious problems, such as flooding or drought. Depending on the region in Canada, changes to the amount of water flowing in rivers can be linked to changes in weather and climate along with other drivers such as human development and increasing water use.

The water quantity indicator provides information about water flows in rivers across Canada from 2009 to 2023 and by monitoring station for 2023. Longer-term trends over a 50-year period provide an assessment of significant changes in flows, including very high and very low flows that can result in flooding or drought, from 1974 to 2023.

National water quantity in Canadian rivers

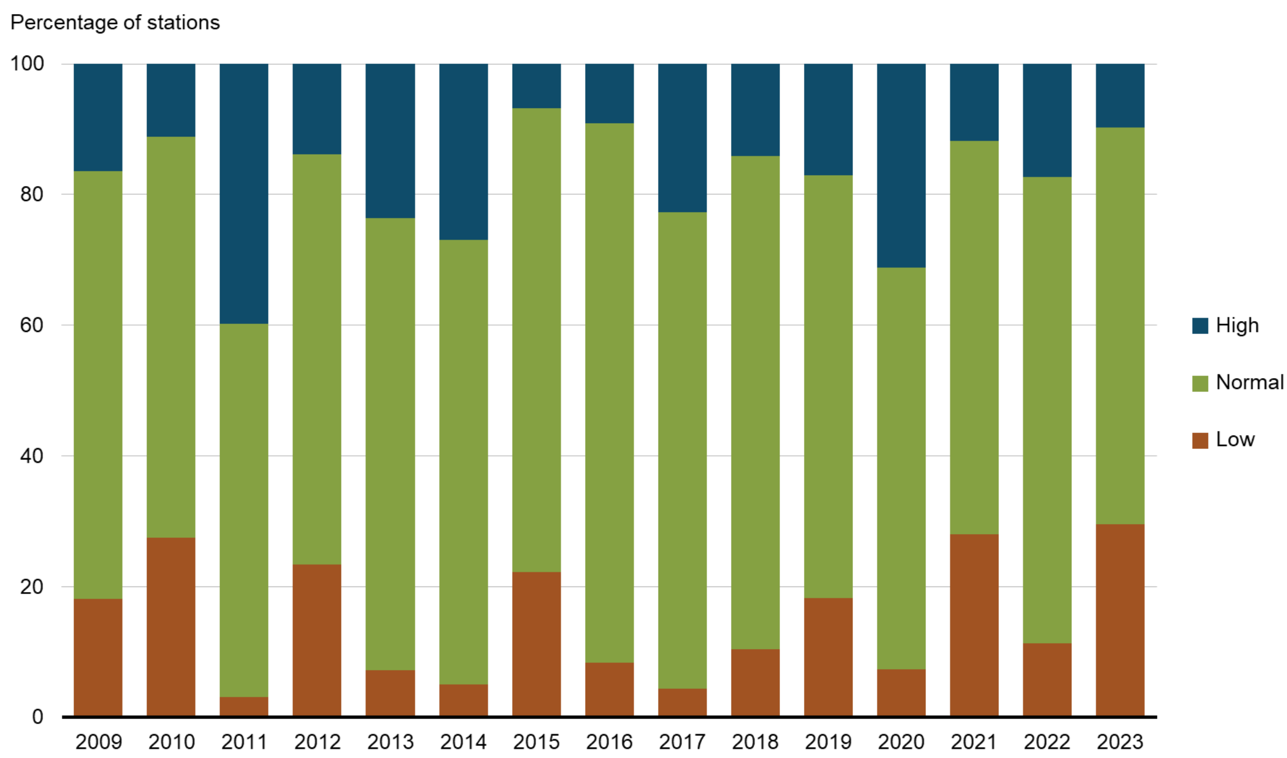
In Canada, nearly every year is marked by weather extremes in parts of the country, which can affect the amount of water in lakes and rivers. Monitoring stations help show whether conditions are normal, drier or wetter than usual. Low water levels can signal droughts, while high levels could indicate flood conditions. These extreme events do not always lead to major seasonal or long-term changes in water quantity but can be reflected when the conditions are persistent throughout the year.

Key results

Overall, in 2023, water quantity in Canada was:

- higher than normal at 10% of the stations
- normal at 61% of the stations
- lower than normal at 29% of the stations

Figure 1. Water quantity at monitoring stations, Canada, 2009 to 2023



Data for Figure 1

Note: The water quantity classification for a station is based on a comparison of the annual water quantity in a given year with typical annual water quantity at that station between 1991 and 2020. For more information, please see the Data sources and methods section.
Source: Environment and Climate Change Canada (2025) National Water Data Archive (HYDAT).

Normal water quantity indicates that a water quantity monitoring station is measuring typical annual values (between 15th and 85th percentiles) for that location when compared with the 30-year average calculated between a normal reference period of 1991 to 2020.

Low water quantity (below 15th percentile) at a monitoring station indicates that drought conditions likely exist. In Canada, droughts normally last for 1 or 2 seasons and can be very damaging. Agriculture, industry and municipalities are especially affected by long-term droughts because they rely on water. Droughts can also affect water quality in lakes and rivers and threaten the survival of ecosystems.

High water quantity (above 85th percentile) at a monitoring station indicates a wet year but does not necessarily mean flooding has occurred. Floods tend to be short lived, lasting on average about 10 days according to the 2015 global mean,[1] and may not change the water quantity classification in this indicator.

From 2009 to 2023,

- The majority of the monitoring stations reported normal water quantity conditions in any given year
- Around 20% of the monitoring stations reported high water quantity conditions in any given year
- Around 20% of the monitoring stations reported low water quantity conditions in any given year
- In dry years (such as the year 2015), very few stations reported high water quantity conditions
- In wet years (such as the year 2011), very few stations reported low water quantity conditions

Water quantity in Canadian rivers is displayed as water flow or discharge, measured as the volume of water per time (cubic meters per second). Water flows in rivers generally follow changes in rainfall, snowmelt, and temperature throughout the year. More precipitation increases the amount of water in rivers, whereas less rainfall or snowfall will result in less water. Generally, water flows are highest right after the snow melts in the early spring and gradually dry up through the summer. These high and low flows can result in flooding or water shortages.

Over longer time scales, the amount of water in rivers is also affected by weather patterns and ocean surface temperatures which interact to influence the amount of rain or snow that falls. For example, extended summer droughts on the Prairies tend to take place when the southern Pacific Ocean warms during El Niño Southern Oscillation events. In other words, in an El Niño year, lower-than-normal water flows are generally seen on the Prairies. The Prairies experience more rain and snow when the ocean cools during La Niña events.[2] When this happens, higher-than-normal flows are found in the Prairies.

National water quantity at monitoring stations

This indicator measures the total water availability across Canada for the year 2023 and classifies the stations as high, normal, or low in comparison to the typical water quantity of the 30-year reference period from 1991 to 2020. However, this does not consider how water availability changes through natural annual cycles (for example, higher flows from snow melt in early spring or lower flows from evapotranspiration in the summer).

Key results

In 2023,

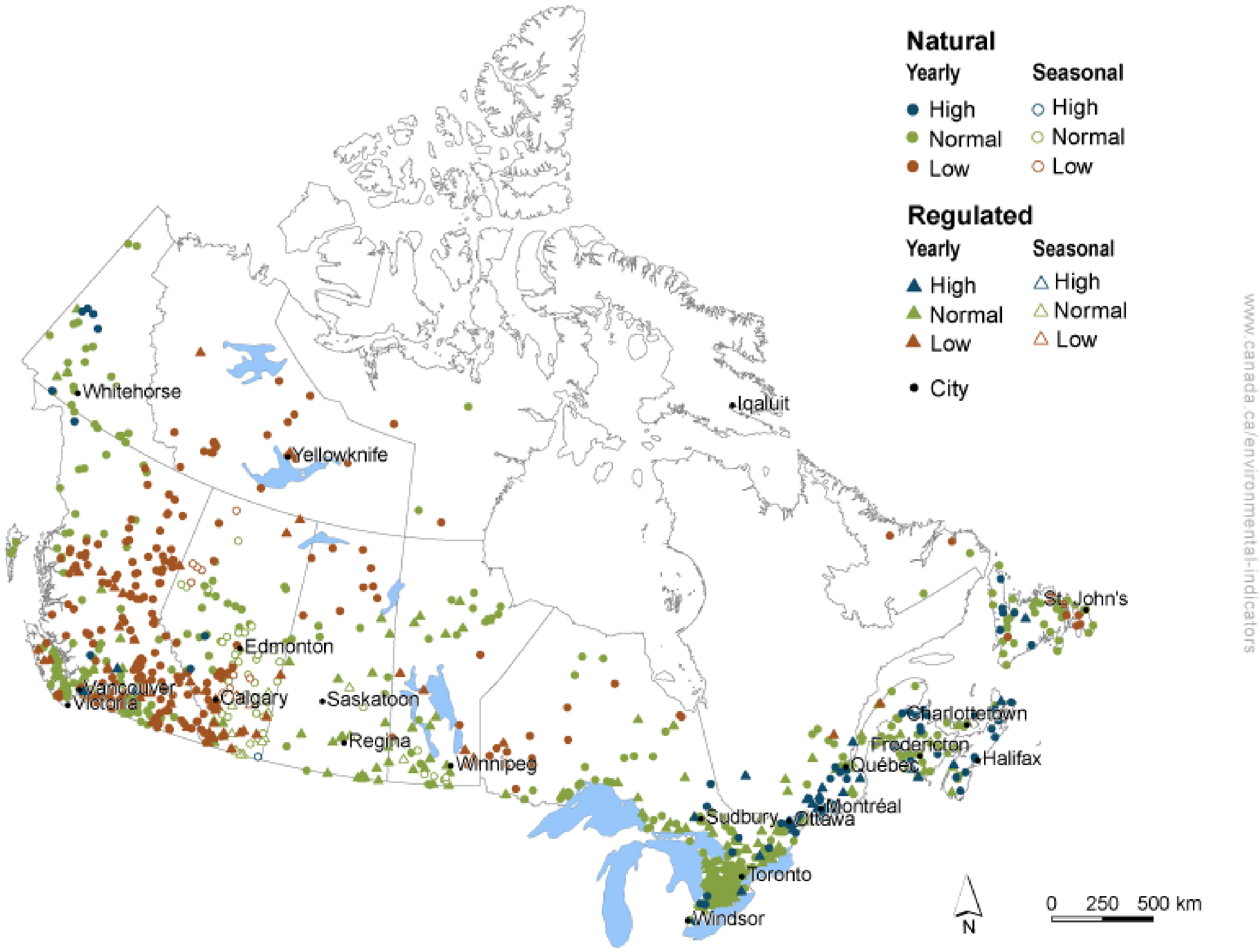
- higher-than-normal water quantity was more frequent at monitoring stations in Yukon, eastern Ontario, Quebec, the Maritimes[3] and western Newfoundland
- lower-than-normal water quantity was more frequent at monitoring stations in the Northwest Territories, Nunavut, British Columbia, Alberta, northern Saskatchewan, central Manitoba, northern Ontario, Labrador, and eastern Newfoundland

[1] Najibi, N. and Devineni, N. (2018) Recent trends in the frequency and duration of global floods. European Geosciences Union, Earth System Dynamics. Retrieved October 12, 2025.

[2] Bonsal, B. and Shabbar, A. (2010) Large-scale climate oscillations influencing Canada, 1900-2008. Canadian Biodiversity: Ecosystem Status and Trends 2010, Technical Thematic Report No. 4. Retrieved on November 3, 2025.

[3] The Maritimes include the provinces of New Brunswick, Nova Scotia, and Prince Edward Island.

Figure 2. Water quantity at monitoring stations, Canada, 2023



Navigate data using the interactive map

Note: The 2023 water quantity classification for a station is based on a comparison of annual water quantity in that year with the typical annual water quantity at that station between 1991 and 2020. Normal water quantities are specific to each region and do not refer to the same amount of water in each drainage region (for example, the normal water quantity on the Prairies is different than the normal water quantity in the Atlantic region). Natural stations are those where human activity upstream of the station has little impact on water flows. Regulated stations have water withdrawals, dams, diversions or other structures upstream that may change the water quantity in the river. Water quantity data for seasonal stations are only collected for part of the year. For more information, please see the Data sources and methods section.
Source: Environment and Climate Change Canada (2025) National Water Data Archive (HYDAT).

Regional water quantity levels

Northern region

In Yukon, most watersheds had near normal snowpack and thus normal water quantity in 2023.[4] However, there were some stations in the Klondike River with above average snow water equivalent, leading to high water quantity upon snowmelt and severe ice jamming and record high flows near Dawson City.[5]

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[4] Turcotte, B. (2023) Significant hydrological events of 2023 in Yukon – smaller scale extremes – Dr. Benoit Turcotte. Retrieved December 10, 2025.

[5] Turcotte, B. (2023) Tr'ondëk (Klondike River) floods: Are we done yet? – Dr. Benoit Turcotte. Retrieved December 10, 2025.

Throughout the Northwest Territories low water levels were seen in 2023, except for Peel River which had above average water levels and flow rates. Water levels started as average to below average in spring 2023, having significantly decreased from record highs in 2020. This was followed by warmer and drier than normal summer and fall seasons which led to record lows in some rivers throughout the territory.[6]

Across the available stations in Nunavut, water quantity conditions varied in 2023, with normal water levels in the Kazan River and Back River, and low water levels in the Thlewiaza River and Baillie River. It was also noted that the ice cover period was shorter than normal due to warmer temperatures, causing delayed freeze-up and earlier ice breakup and snowmelt.[7]

Pacific region

Throughout British Columbia, many stations showed low water quantity due to the unprecedented long-term drought that began in 2021 and continued until 2023. Particularly in 2023, the heat brought on the earliest mountain snowmelt seen since 1988 and caused most of the province's watersheds to experience at least one week of the highest drought level.[8] There were, however, some stations with normal water quantity around Vancouver, the Haida Gwaii archipelago and the southern tip of the Yukon River basin.

Prairies region

In Alberta, especially central Alberta, most stations had normal water levels in 2023. However, there were some monitoring stations that recorded low water levels, particularly in the northern Hay River and Peace/Slave River basins, as well as in the southern South Saskatchewan River basin. This was due to low snowpack and prolonged lack of summer precipitation, causing some reservoirs such as the Oldman Reservoir and St. Mary Reservoir, to hit record low levels.[7]

Saskatchewan had normal water quantity throughout the province in 2023, except for the northern region in the Athabasca River basin which had low water levels. This was due to severe drought that spanned from Reindeer Lake in the east to Buffalo Narrows in the west.[7]

Across Manitoba, annual water levels in 2023 were normal, except for some stations around Lake Winnipeg showing lower water levels. In southern Manitoba, water levels steadily declined from spring into the summer and fall, causing extreme drought due to low precipitation.[7]

Central region

Across Ontario, annual water levels were mostly normal in 2023. There were some stations in the south of the province with high water levels, likely related to the above average levels of Lake Michigan-Huron and Lake Erie.[9] Dry conditions continued in northern Ontario, causing stations to have low water levels and contributing to wildfires.[10]

In Quebec, in 2023, the annual water quantity showed high water levels in the St. Lawrence River, before returning to normal water levels as it approached the Gulf of St. Lawrence. However, 2 stations in the North Shore-Gaspé basin (at Matane and Chicoutimi rivers) showed low water levels.

Atlantic region

In New Brunswick, most stations had normal annual water levels in 2023. There were some stations with high levels off the northern coast along the Chaleur Bay, inlet to the Gulf of St. Lawrence, and in the south along the St. Croix River, the international border between New Brunswick, Canada and Maine, United States.

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[6] Government of Northwest Territories (2024) 2024 NWT Spring Water Outlook (PDF; 1.95 MB). Retrieved December 10, 2025.

[7] Environment and Climate Change Canada (2025) Canada Water Act Annual Report for 2023–2024 - Canada.ca. Retrieved December 10, 2025.

[8] Report for B.C. Ministry of Health (2024) Climate Change and Health in British Columbia: From Risk to Resilience (PDF; 26.99 MB). Retrieved December 10, 2025.

[9] Environment and Climate Change Canada (2024) LEVELnews: Great Lakes and St. Lawrence River water levels, January 2024 - Canada.ca. Retrieved December 10, 2025.

[10] Environment and Climate Change Canada and U.S. National Oceanic and Atmospheric Administration (2023) 2023 Annual Climate Trends and Impacts Summary for the Great Lakes Basin (PDF; 5.18 MB). Retrieved December 10, 2025.

Most stations in northeastern Nova Scotia had high water levels, with some normal water levels in southwestern Nova Scotia beyond Halifax. In July 2023, Nova Scotia experienced the most intense rainfall since Hurricane Beth in 1971, resulting in a series of flash floods across the province, causing several fatalities and widespread damage to infrastructure.[11]

The annual water quantity in Prince Edward Island, in 2023, was normal across the province, except for Bear River at St. Margarets station on the eastern end which had high water levels.

In Newfoundland and Labrador, the 2023 annual water quantity was mostly normal. However, there were some stations with high levels on the northwestern side of Newfoundland, and some low levels near St. John's and in northern Labrador.

Trends in annual water quantity in Canadian rivers

This indicator measures the change in total water availability at monitoring stations across Canada for the 50-year period of 1974 to 2023, in comparison to the typical water quantity of the 30-year reference period from 1991 to 2020. However, this does not consider how water availability changes through natural annual cycles (for example, higher flows from snow melt in early spring or lower flows from evapotranspiration in the summer).

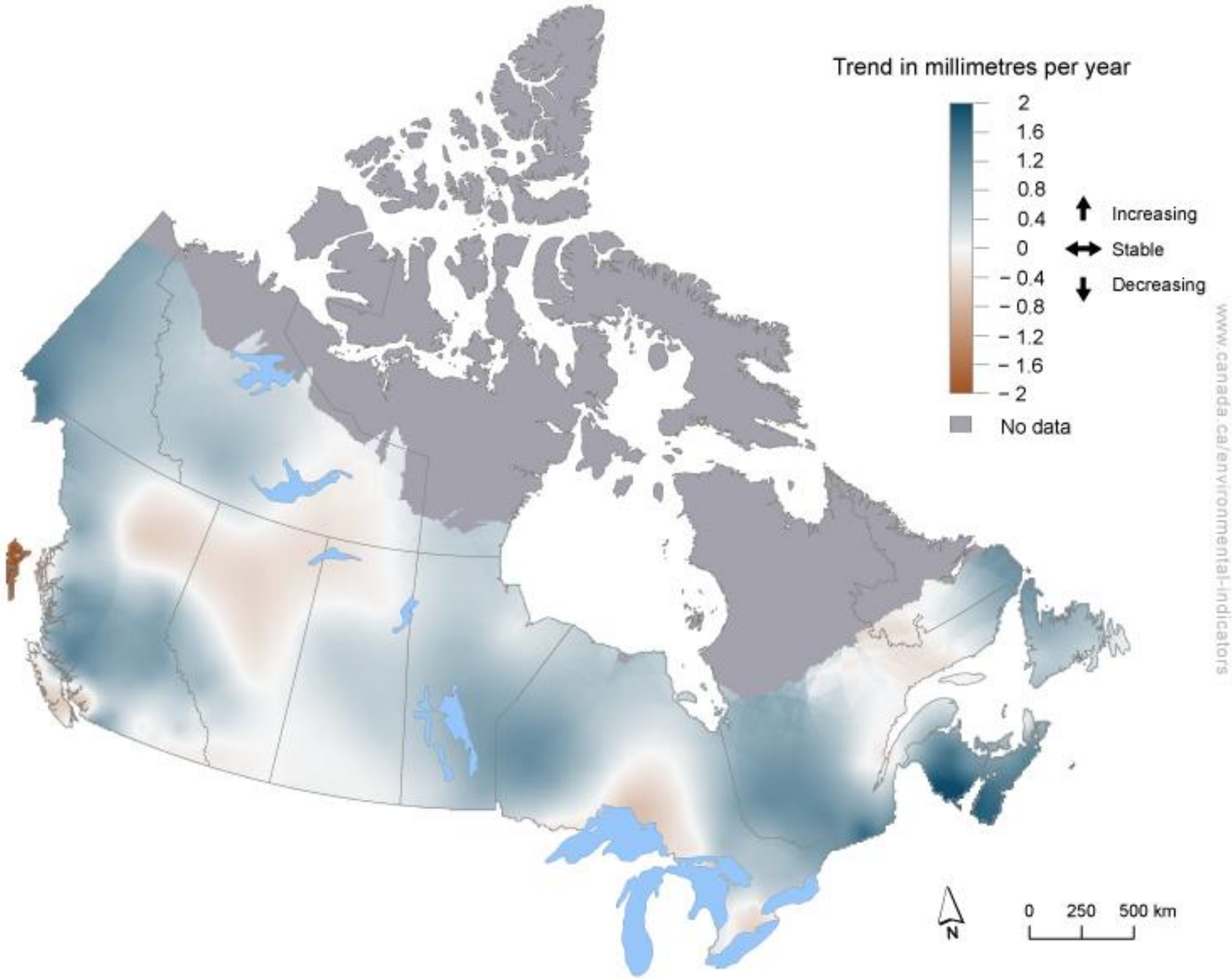
Key results

- Across Canada over the 50-year period from 1974 to 2023:
    - increasing trends in annual water quantity were observed at monitoring stations in Yukon, western Northwest Territories, southern British Columbia, central Saskatchewan, Manitoba, northern Ontario, southern Quebec, and Atlantic Canada[12]
    - decreasing trends were observed in eastern Northwest Territories, the Haida Gwaii archipelago off the north coast of British Columbia, southern Vancouver Island, northeastern British Columbia, northern Alberta, northern Saskatchewan, southern Ontario, and eastern Quebec
- From 1974 to 2023, the greatest increases in water flows were observed along the coastline of New Brunswick

[11] Halifax Regional Municipality (2025) Recent memories of floods | Halifax. Retrieved December 10, 2025.

[12] Atlantic Canada includes the provinces of New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland and Labrador.

Figure 3. Annual rate of change in water quantity at monitoring stations, Canada, 1974 to 2023



Data for Figure 3

Note: The indicator is based on a statistical analysis of annual water quantity at monitoring stations over the 1974 to 2023 period. Annual water quantity for each monitoring station was determined by adding the daily water flows for stations over an entire year and then dividing the annual totals by the area of the contributing watershed for a depth in millimetres. A statistical analysis was then applied to the resulting values to determine if there was a trend. Positive trend values indicate that the annual water quantity at a station has increased over time, negative values indicate a decrease, and zero values indicate that the annual water quantity has remained the same over time. For more information, please see the Data sources and methods section.
Source: Environment and Climate Change Canada (2025) National Water Data Archive (HYDAT).

Across Canada, trends[13] in annual water quantity tend to mirror trends in precipitation. Long term increases in precipitation have been observed over southern coastal British Columbia, New Brunswick, Ontario and in Québec. This is consistent with the increasing trends in annual flows observed over these regions.

[13] The existence of a trend does not necessarily predict future trends in annual water quantity across Canada. For information on projections of future freshwater trends in Canada, see Canada's Changing Climate Report Chapter 6: Changes in freshwater availability across Canada. Retrieved on November 3, 2025.

Regional trends in annual water quantity

Northern region

Throughout Yukon, the annual water quantity is increasing. Melting of the glaciers in southwestern Yukon and thawing of the permafrost have contributed to an overall increase of water quantity observed across the territory in recent decades.[14]

In the western Northwest Territories, the Mackenzie Great Bear basin has seen an overall increase in annual water quantity. Over time, warmer winter temperatures have altered seasonal flow, leading to reduced snow and ice covers, earlier river ice breakup and reduced spring river peak flows since the 1970s. However, annual winter and early spring river flows have increased by up to 2% per year.[18] In the eastern Northwest Territories, the Great Slave Lake basin has seen decreasing water quantity, particularly in the Slave River, Taltson River and Mackenzie River. Snow cover has decreased since 1980, with observed changes in snow texture and quality. These changes are due to climate change, combined with flow regulation on the Peace River by the W.A.C. Bennett Dam.[15]

For most of Nunavut, there is insufficient data to draw conclusions on trends in water quantity. However, a slight increasing trend in annual water quantity has been observed in the Kazan River in the south. In the Nunavut Arctic, climate change effects due to warmer temperatures have been evident from melting glaciers, declining ice thickness, rising sea levels and increased extreme weather events. These are causing significant changes to nature such as to the permafrost regime, hydrology of the tundra, behavior of wildlife, and growth of vegetation. Subsequent human impacts include destabilized foundations of infrastructure that relied on permafrost, reduced hydroelectric energy potential from unreliable flow patterns and food insecurity from disruption of traditional hunting, fishing and gathering.[16]

Pacific region

Off the coast of British Columbia, the Haida Gwaii archipelago and Vancouver Island are showing decreasing trends in annual water quantity due to the increasing frequency and intensity of summer droughts caused by climate change.[17] In contrast, the Fraser River basin in central British Columbia is increasing in annual water quantity, with decreasing summer flows, and increasing winter and spring flows.

Prairies region

Alberta annual water quantity trends show decreases in northern Alberta in the Peace River and Athabasca River basins. This is thought to be due to both climate change and an increase in surface water diversion for industrial uses, such as hydroelectric and hydraulic fracturing activities, in recent years.[15] On the other hand, southern Alberta is showing slight increases in water quantity, particularly along the Rocky Mountains.

Across Saskatchewan, annual water quantity levels are mostly stable with some slight increases in the central region and some decreases in the northern region. In the Athabasca basin, Indigenous communities have also observed lower water levels in the Athabasca River due to increased industrial water withdrawals in recent years.[15]

All of Manitoba is showing increasing annual water quantity trends, particularly around Lake Winnipeg. Both inflows and outflows of Lake Winnipeg have significantly increased over the years by 44% and 53%, respectively, when comparing to past decades.[18]

Central region

Across Ontario, annual water quantity trends are increasing with the exceptions of decreasing trends just above the Great Lakes from Lake Superior to Lake Erie. This suggests that recently, more of the water is being pushed through the interconnected basin into the St. Lawrence River in Quebec. The Great Lakes basin has been

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[14] Yukon Water (2025) Changes to water resources - Yukon Water. Retrieved on December 10, 2025.

[15] Mackenzie River Basin Board (2021) SOAER – Mackenzie River Basin State of the Aquatic Ecosystem Report. Retrieved on December 10, 2025.

[16] Nunavut Climate Change Secretariat (2025) FAQS – Climate Change Secretariat. Retrieved on December 10, 2025.

[17] Government of British Columbia (2025) BC Drought Information Portal - Historical Drought Levels. Retrieved on December 10, 2025.

[18] Environment and Climate Change Canada (2020) State of Lake Winnipeg (PDF; 33.19 MB). Retrieved on December 10, 2025.

monitored for over a century, but records indicate no regular, predictable cycle. It is known to fluctuate between random-length periods of high and low levels, sometimes only affecting some and not all lakes.[19]

Within southern Quebec, the more northern regions are more stable or slightly decreasing, while the more southern regions are showing an increasing trend in annual water quantity. Warming temperatures from climate change are affecting the north more strongly than the south. It is predicted that there will be more precipitation overall, with more snow but less rain in the north, where temperatures remain below freezing for much of the winter (for example, the Côte-Nord), and more rain but less snow in the south, where temperatures are milder (for example, the Montérégie).[20]

Atlantic region

Throughout New Brunswick, particularly in the south, there is an increasing trend in annual water quantity. In Fredericton and Moncton, there were more extreme rainfall events occurring between 2000 and 2010, compared to any other decade on record. The annual precipitation throughout New Brunswick is predicted to continue increasing with less frequent, but more intense rain and snow events.[21]

Nova Scotia has exhibited an increasing trend in annual water quantity over the past 50 years, especially in the southwestern portions of the Bay of Fundy and Gulf of St. Lawrence basin, and the Southeastern Atlantic Ocean basin. This is likely tied to climate change with more rain and less snow from warming temperatures, more tropical storms and storm surges, and rising sea levels around the coasts.[22]

Prince Edward Island is seeing an increasing trend in annual water quantity, though not as strong as the rest of the Atlantic region. This is likely related to climate change effects causing rising sea levels, more frequent and severe post-tropical storms and less sea ice.[23]

Newfoundland and Labrador are showing slight increasing trends in annual water quantity. Climate change is the likely cause of this involving melting sea ice, unstable and thawing permafrost, sea-level rise, more storm surges, storms and flooding.[24]

Trends in the number of high flow days in Canadian rivers

High flow days are used to describe days where water flows could have been high enough to cause flooding but do not necessarily represent actual recorded or reported flood events. Floods may be described by how long they last, how often they occur, or how high they rise onto the land.

This indicator measures how the number of very high flow days have changed at monitoring stations across Canada over the 50-year period of 1974 to 2023, compared to the typical water flows of the 30-year reference period of 1991 to 2020. Very high flows are defined as flows greater than the 95th percentile of the flows measured during the 30-year reference period.

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[19] Fisheries and Oceans Canada (2022) Fluctuations in Great Lakes levels. Retrieved on December 10, 2025.

[20] Gouvernement du Québec (2022) Guide de l'Atlas Hydroclimatique du Québec Méridional 2022 (PDF; 2.72 MB) (only in French). Retrieved on December 10, 2025.

[21] Conservation Council of New Brunswick (2025) How and Why Climate Change is Affecting New Brunswick. Retrieved on December 10, 2025.

[22] Province of Nova Scotia (2022) Weathering What's Ahead: Climate Change Risk and Nova Scotia's Well-being (PDF; 4.35 MB). Retrieved on December 10, 2025.

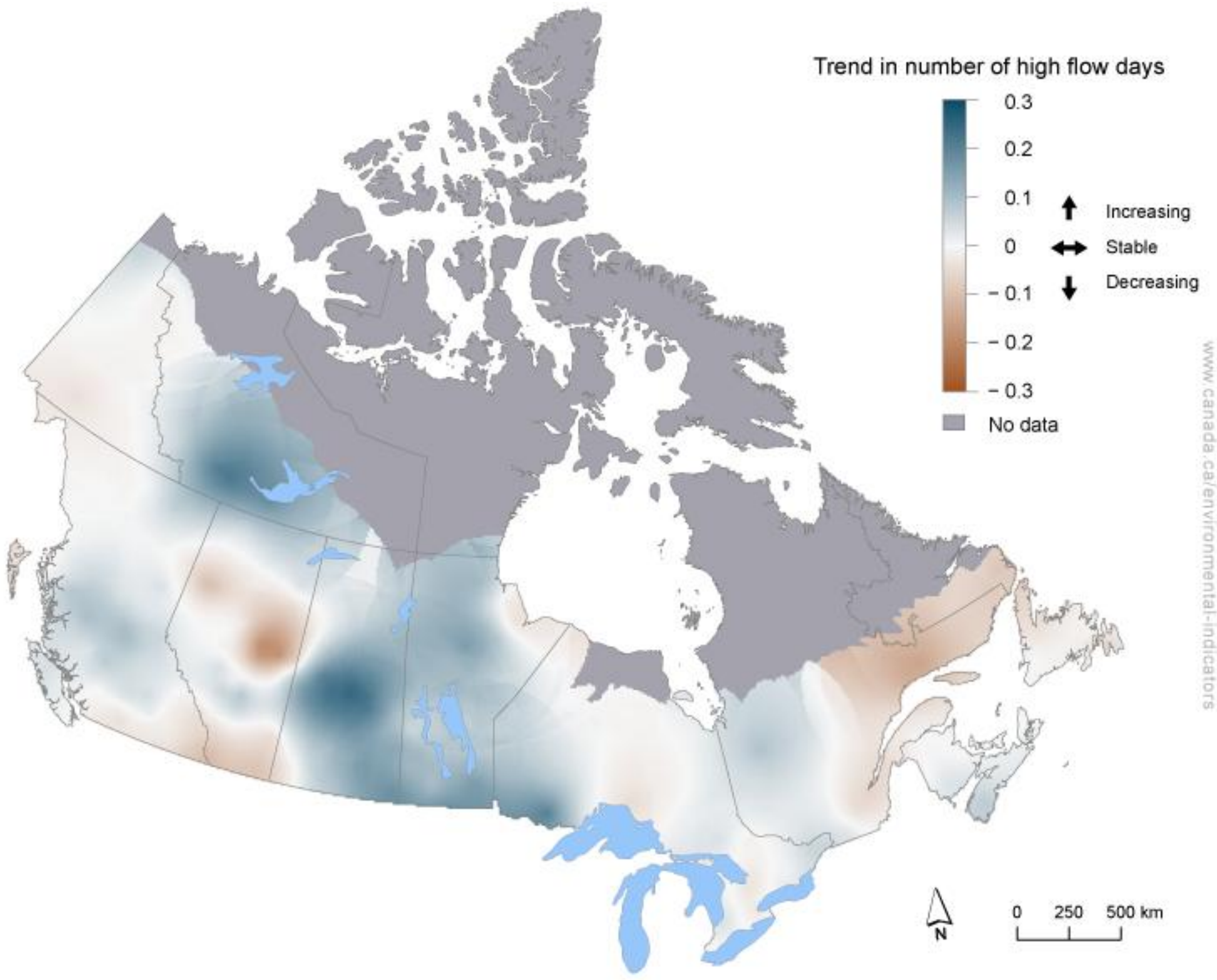
[23] Government of Prince Edward Island (2024) Erosion and Flooding – Government of Prince Edward Island. Retrieved on December 10, 2025.

[24] Government of Newfoundland and Labrador (2025) About the Issues - Environment, Conservation and Climate Change. Retrieved on December 12, 2025.

Key results

- Across Canada over the 50-year period from 1974 to 2023:
  - increasing trends in the number of high flow days were observed at monitoring stations in the Northwest Territories, Saskatchewan, Manitoba, and western Ontario, with smaller increases in central British Columbia, southwestern Quebec, and Nova Scotia
  - decreasing trends were observed at stations in Alberta, southeastern Quebec, and Labrador, with smaller decreases in southern British Columbia and central Ontario

Figure 4. Annual rate of change in the number of high flow days at monitoring stations, Canada, 1974 to 2023



Data for Figure 4

Note: The indicator is based on a statistical analysis of the annual number of high flow days at monitoring stations over the 1974 to 2023 period. It shows the prevalence of high flow conditions (above the 95th percentile of all daily flow values for a monitoring station compared to a 30-year normal period from 1991 to 2020). This may be linked to flooding events but does not represent actual recorded or reported events. Positive values indicate that the number of days with very-high flows over the 1974 to 2023 period have increased, negative values indicate a decrease, and zero values indicate that the number of high flow days have remained the same. For more information, please see the Data sources and methods section.
Source: Environment and Climate Change Canada (2025) National Water Data Archive (HYDAT).

Many factors can cause high flows, including intense and/or long-lasting precipitation, snowmelt, ice jams on rivers or rain-on-snow events. Rising temperatures, along with reductions in snow cover, may also result in a downward trend in high flow days by reducing the magnitude of runoff from snowmelt.[25] Regional variations could be explained by a combination of these factors.

Regional trends in the number of high flow days

Northern region

In Yukon, the trend of annual maximum flow appears to be stable with no significant changes seen thus far. However, ice breakup on the Yukon River is shown to be occurring slightly earlier on average due to climate change effects. This could have implications on the timing and intensity of breakup, and as such, severity of ice jams which often lead to flooding.[26]

In the Northwest Territories, there is an increasing trend in the number of high flow days to the west and northwest of the Great Slave Lake. This is likely related to the significant expansion in the size of several lakes in this area including Falaise Lake, Trio Lakes, Jackie Lake and Chan Lake. Increases in lake area have gone up by up to 800% and the total amount of water in this region has doubled since 1986.[27] Additionally, consistent increases in winter flows and winter rainfall due to warmer temperatures have been observed across the Great Slave basin.

In Nunavut, there is insufficient data for representative trend analysis of high flow days.

Pacific region

Trends in high flow days in British Columbia have been relatively stable with slight increases in central British Columbia in the Fraser River basin, and slight decreases in the southern part of the province in the upper Columbia River and the Haida Gwaii archipelago. Major flooding occurred in the spring of 2023 in northwestern British Columbia. along the Skeena River and interior British Columbia in the Village of Cache Creek. Long-term trends indicate increasing flood risk due to larger and more frequent heavy precipitation events and the possibility of overland floods after droughts.[28]

Prairies region

In central and southern Alberta, including the Peace River, Athabasca River, Beaver River, South Saskatchewan River and Milk River basins, there are decreasing trends in high flow days. This likely correlates to the decreasing annual water quantity trend in those regions.

In south-central Saskatchewan, there is a notable increasing trend in high flow days, particularly in the Churchill River and Saskatchewan River basins. Flooding in Saskatchewan typically results from major thunderstorms, intense rain showers and high spring runoff which are predicted to increase with climate change.[29]

Across Manitoba, there is an increasing trend in high flow days. Climate models are expecting southern Manitoba to experience wetter springs in 2051 to 2080 compared to 1976 to 2005.[30] As a result, river basins such as the Red River and Assiniboine River, which are already prone to flooding from spring snowmelt, may face increasing flood risk.[31]

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[25] Government of Canada (2019) Canada's Changing Climate Report; Chapter 6: Changes in freshwater availability across Canada. Retrieved on November 3, 2025.

[26] Government of Yukon (2024) Interim State of the Environment Report 2024 (PDF; 9.89 MB). Retrieved on December 10, 2025.

[27] Mackenzie River Basin Board (2021) SOAER – Mackenzie River Basin State of the Aquatic Ecosystem Report. Retrieved on December 10, 2025.

[28] Report for B.C. Ministry of Health (2024) Climate Change and Health in British Columbia: From Risk to Resilience (PDF; 26.99 MB). Retrieved December 10, 2025.

[29] Prairie Adaptation Research Collaborative (2025) SaskAdapt - Thunderstorms, Heavy Rainfall & Flooding. Retrieved on December 10, 2025.

[30] Prairie Climate Centre (2019) Manitoba and Climate Change (PDF; 3.10 MB). Retrieved on December 10, 2025.

[31] Government of Manitoba (2025) Province of Manitoba – Flood Information. Retrieved on December 10, 2025.

Central region

Across Ontario, the number of high flow days have been relatively stable. There is a slight increasing trend in northwestern Ontario which may be influenced by the increasing annual water quantity and high flow days from Manitoba. In the urban watersheds, increased severe thunderstorms resulting in high intensity but short duration rainfall is a major driver for flooding. Warmer weather due to climate change is also causing earlier spring breakup with concerns of increasing autumn ice jams.[32]

In southern Quebec, the trend in high flow days is similar to the annual water quantity, with increases in the south and decreases in the north. In the northern regions (such as the St. Lawrence Valley), there will be more precipitation falling as snow. This increased snowpack will then increase runoff and potential high flow days in the spring. In the southern regions (such as Gaspésie and the Outaouais), the increased rain precipitation will not be enough to offset the decreased snowfall. Therefore, flows and potential high flow days are expected to decrease in the spring.[33]

Atlantic region

New Brunswick has seen a relatively stable number of high flow days over the years. However, it regularly experiences flooding due to ice jams increasing river water levels, overland flooding from heavy rain and snowmelt and coastal flooding from storm surges along the coastline.[34] The Saint John River is particularly known to experience recurring floods and recently experienced record-breaking floods in 2018 and 2019.[35]

Nova Scotia has also seen a relatively stable number of high flow days over the years, with slight increases in the southwestern portions of the Bay of Fundy and the Gulf of St. Lawrence basin, and the Southeastern Atlantic Ocean basin. Flooding occurs regularly in Nova Scotia, especially in the Salmon River and North River which feed into Cobequid Bay, an inlet of the Bay of Fundy. They can be caused by heavy rainfall, snowmelt, ice jams, high tides, storm surge, or a combination of each.[36]

Similarly, Prince Edward Island has seen a relatively stable number of high flow days over the years. Although, unlike the rest of the Atlantic region, Prince Edward Island has smaller rivers, making fluvial flooding less of a concern. However, pluvial flooding, coastal flooding and coastal erosion still occur and are expected to increase with climate change effects and increased development in vulnerable areas.[37]

In Newfoundland, the number of high flow days has been relatively stable but has been decreasing in southeastern Labrador.

Trends in the number of low flow days in Canadian rivers

Low flow days are used to describe days of hydrological drought, when water supplies in the rivers are lower than normal during the summer. [38] This indicator measures how the number of very low flow days in summer has changed at monitoring stations across Canada over the 50-year period of 1974 to 2023, compared to the typical water flows from the 30-year reference period of 1991 to 2020.

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[32] Government of Ontario (2020) Protecting people and property: Ontario's flooding strategy. Retrieved on December 10, 2025.

[33] Gouvernement du Québec (2022) Guide de l'Atlas Hydroclimatique du Québec Méridional 2022 (PDF; 2.72 MB) (only in French). Retrieved on December 10, 2025.

[34] Government of New Brunswick (2025) Flood risk information and history. Retrieved on December 10, 2025.

[35] Conservation Council of New Brunswick (2025) How and Why Climate Change is Affecting New Brunswick. Retrieved on December 10, 2025.

[36] Government of Nova Scotia (2025) Flooding – Climate Change. Retrieved on December 10, 2025.

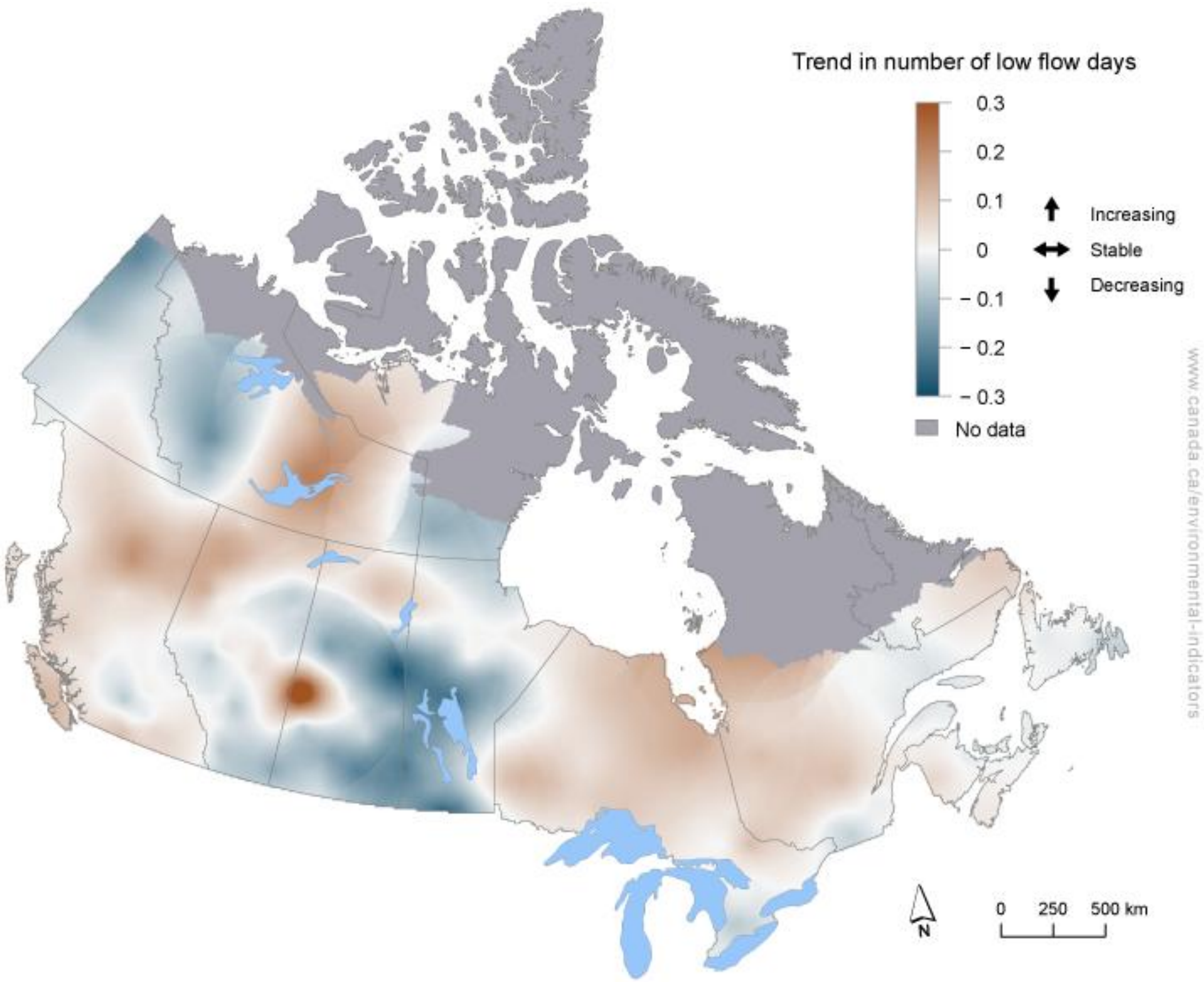
[37] Government of Prince Edward Island (2024) Erosion and Flooding – Government of Prince Edward Island. Retrieved on December 10, 2025.

[38] The summer period is defined as the period between peak spring flow due to snowmelt and October 1, unless peak spring flow occurs before May 1 in which case the period is May 1 to October 1.

Key results

- Across Canada over the 50-year period from 1974 to 2023:
  - increasing trends in the number of low flow days were observed at monitoring stations in eastern Northwest Territories, British Columbia, northern Prairies (particularly in western Saskatchewan), Ontario, Quebec, and Atlantic Canada
  - decreasing trends were observed at stations in northern Yukon, western Northwest Territories, and southern Prairies

Figure 5. Annual rate of change in the number of low flow days at monitoring stations, Canada, 1974 to 2023



Data for Figure 5

Note: The indicator is based on a statistical analysis of the annual number of low flow days at monitoring stations over the 1974 to 2023 period. It shows the prevalence of very-low flow conditions during the summer (when daily flow values fall outside a threshold of all daily flow values for a monitoring station compared to a 30-year normal period from 1991 to 2020) which may be linked to drought events but does not necessarily represent actual recorded or reported events. Positive values indicate that the number of days with very-low flows over the 1974 to 2023 period have increased, negative values indicate a decrease, and zero values indicate that the number of days have remained the same. For more information, please see the Data sources and methods section.
Source: Environment and Climate Change Canada (2025) National Water Data Archive (HYDAT).

Drought is a prolonged dry period in the climate cycle and there are 4 ways it can be defined:

- meteorological (when rainfall and snowfall is lower than normal)
- agricultural (when the amount of moisture in soil no longer meets the needs of crop plants)

- socioeconomic (when water shortages begin to affect people); and
- hydrological (when water supplies in lakes, rivers and groundwater are lower than normal)

For perennial streams, where water flows all summer long, very low flows are defined as flows that drop below a threshold,[39] calculated from the 30-year reference period of 1991 to 2020. For intermittent streams, where streams typically run dry for part of the summer, low flow days are defined as when a dry period lasts longer than what is normally seen in 90% of summers, based on the 30-year reference period of 1991 to 2020.

Many factors can contribute to low flows including deforestation, wildfires, surface water and groundwater withdrawals, river diversions, dams, low precipitation and evapotranspiration. The regional variations in flows can be explained by combinations of these factors. The indicator integrates the responses from those factors but does not measure whether there is enough water to meet the needs of people and ecosystems relying on the available water.

Regional trends in the number of low flow days

Northern region

In Yukon, there is generally an increasing trend in the amount of annual low flows across the territory, meaning an increase in winter flows. This is accompanied with a trend towards a deeper snowpack, which has seen an average increase of about 20% since 1980.[40]

In the western Northwest Territories, the Mackenzie Great Bear basin is seeing a decreasing trend of low flow days, consistent with an increasing trend in water quantity. In the eastern Northwest Territories, the Great Slave Lake basin is seeing an increasing trend of low flow days, consistent with a decreasing trend in water quantity. There have been reports of tributaries and side channels of the Slave River and Taltson River drying out and becoming impassable by boat. Similarly, lower water levels in the Mackenzie River have also disrupted local boat travel and navigation.[41]

In southern Nunavut, the number of low flow days are decreasing in the Kazan River. Meanwhile, in western Nunavut, the number of low flow days are increasing in the Back River.

Pacific region

Over the years, British Columbia has seen an increasing number of low flow days across most of the province, particularly in the Peace River basin. This signifies increased duration and frequency of seasonal drought, and subsequent wildfire risk. This is a result of climate change effects characterized by decreased snow accumulation, warmer summers and reduced summer rainfall.[42]

Prairies region

The Prairies are more likely to experience drought because of a combination of interrelated factors such as:

- location and weather patterns: the Prairies are located inland, far from moisture sources (oceans), resulting in lower precipitation; the Rockies also create a rain-shadow effect that dries air masses[43]
- semi-arid climate: this region has naturally lower average precipitation compared to other parts of Canada; this inherent dryness makes the region more susceptible to drought conditions, even small variations in precipitation levels can have a significant impact on the availability of water resources

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[39] Thresholds are used to define low flows in rivers, and the indicator is the number of days during summer when flows fall outside the threshold. Different types of thresholds are used for streams that flow all summer and streams that typically run dry for periods of the summer. For more information, please see the Data sources and methods section.

[40] Government of Yukon (2024) Interim State of the Environment Report 2024 (PDF; 9.89 MB). Retrieved on December 10, 2025.

[41] Mackenzie River Basin Board (2021) SOAER – Mackenzie River Basin State of the Aquatic Ecosystem Report. Retrieved on December 10, 2025.

[42] Report for B.C. Ministry of Health (2024) Climate Change and Health in British Columbia: From Risk to Resilience (PDF; 26.99 MB). Retrieved December 10, 2025.

[43] Air masses moving eastward are forced to rise over the Rocky Mountains. As the air rises, it cools and releases moisture in the form of precipitation. By the time these air masses reach the Prairies, they have already lost much of their moisture, creating a rain shadow effect where the eastern side of the Rockies (including the Prairies) receives less rainfall.

- topography and land cover: the large grassland areas in the Prairies are more susceptible to moisture loss through evapotranspiration; agricultural practices and land use changes can also impact the land's ability to retain moisture, exacerbating the effects of dry conditions
- historical variability: the Prairies have a history of experiencing natural climate variability, including periods of drought; these historical trends suggest that the region is more prone to fluctuations in precipitation and the occurrence of extended dry periods[44]

In northern and east-central Alberta, there are increasing trends in low flow days, specifically in the Peace River basin and the Beaver River basin. These changes are due to climate change, combined with flow regulation on the Peace River by the W.A.C. Bennett Dam.[45] There are also slightly decreasing trends in low flow days in southern Alberta, particularly along the Rocky Mountains.

Most of Saskatchewan is seeing a decrease in low flow days, except for in the west-central and northern regions where there are increasing trends. Saskatchewan's climate often experiences extremes and high variability in temperature and precipitation. As such, drought is common and can persist over many years.[46] In the west-central, the region between Lloydminster and Cold Lake on the border of Alberta and Saskatchewan, has been particularly prone to drought over the years. In the northern region of the Athabasca River, the increase in low flow days may be related to the increased industrial water withdrawals.[45]

Most of Manitoba is exhibiting decreasing trends in low flow days, consistent with the increasing annual water quantity and high flow day trends. However, climate models are expecting southern Manitoba to get drier summers in 2051 to 2080 when compared to 1976 to 2005, which could mean both flooding and drought in the same year.[47]

Central region

Across all of Ontario, there is an increasing trend of low flow days. The increase in average annual temperature due to climate change is causing hotter and drier summers, shorter and milder winters, and less snowpack and subsequent spring snowmelt.[48]

Most of Quebec is seeing an increase in low flow days, except for the southern tip where Lake Ontario flows into the St. Lawrence River. In Quebec, low flow days occur in the winter due to snow but with warming temperatures and more rain than snow, winter low flow days are expected to decrease. However, summer and fall low flow days, and potential drought, are expected to increase due to evapotranspiration, more frequent heat waves, and longer periods without precipitation.[49]

Atlantic region

Particularly in southern New Brunswick, there is a slight increasing trend in the number of low flow days. Despite an increase in annual total precipitation and water quantity across the province, climate change is causing less frequent but more intense storms, resulting in longer dry periods and more heatwaves in between these precipitation events.[50]

In Nova Scotia, the trend of low flow days is mostly stable, with slight increases in the southwestern portions of the Bay of Fundy and Gulf of St. Lawrence basin and the Southeastern Atlantic Ocean basin. Nova Scotia has

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[44] Bonsal et al. (2011) Drought Research in Canada: A review, Atmosphere-Ocean, 49(4):303-319. doi: 10.1080/07055900.2011.555103

[45] Mackenzie River Basin Board (2021) SOAER – Mackenzie River Basin State of the Aquatic Ecosystem Report. Retrieved on December 10, 2025.

[46] Prairie Adaptation Research Collaborative (2025) SaskAdapt - Drought. Retrieved on December 10, 2025.

[47] Prairie Climate Centre (2019) Manitoba and Climate Change (PDF; 3.10 MB). Retrieved on December 10, 2025.

[48] Ministry of Health and Long-Term Care (2016) Ontario Climate Change and Health Vulnerability and Adaptation Assessment Guidelines (PDF; 2.12 MB). Retrieved on December 10, 2025.

[49] Gouvernement du Québec (2022) Guide de l'Atlas Hydroclimatique du Québec Méridional 2022 (PDF; 2.72 MB) (only in French). Retrieved on December 10, 2025.

[50] Conservation Council of New Brunswick (2025) How and Why Climate Change is Affecting New Brunswick. Retrieved on December 10, 2025.

seen more extreme summer droughts since 2016, with particularly dry conditions in 2023.[51] This trend is expected to continue as summer temperatures rise, and winter season shortens with climate change.[52]

The trend of low flow days is stable in Prince Edward Island.

Newfoundland is showing slight variations in the trend of low flow days across the province but remains stable overall. The eastern part of Labrador, however, shows slightly increasing trends (for example, Alexis River near Port Hope Simpson).

About the indicator

What the indicator measures

The indicator provides a national summary of the annual water quantity status in rivers across Canada from 2009 to 2023 and by monitoring station in 2023.

A station's water quantity status is determined by comparing the measured annual water quantity to typical water quantity observed at that site for a 30-year period from 1991 to 2020. A station described as having a low water quantity had a measured value ranking among the lowest 15% of values observed from 1991 to 2020. A station described as having a high water quantity had a measured value ranking among the highest 15% of values observed from 1991 to 2020.

The indicator also offers trends that provide an assessment of whether there have been significant observed changes over time in water quantity, of very-high and very-low flows, at monitoring stations across Canada for a 50-year period from 1974 to 2023.

Why the indicator is important

Canada has 0.5% of the world's population but has approximately 7% of the world's renewable freshwater supply. Canada may have plentiful water, but it is not evenly distributed; water is in short supply in some parts of the country. Canadians use water in agriculture, in industry and in their homes.

The indicator provides information about the state of the amount of surface water in Canada and its change through time to support water resource management.

Related initiatives

The indicator supports the measurement of progress towards the following 2022 to 2026 Federal Sustainable Development Strategy long-term Goal 6: Ensure clean and safer water for all Canadians.

In addition, the indicators contribute to the Sustainable Development Goals of the 2030 Agenda for Sustainable Development. They are linked to the 2030 Agenda's Goal 6: Clean water and sanitation.

Related indicators

The Extreme heat events indicators report trends in the cumulative number of days per year and in the average number of degrees Celsius per year of extreme heat conditions at weather stations across Canada.

The Precipitation change in Canada indicators present annual and seasonal precipitation departures in Canada.

The Sea ice in Canada indicators provide information on variability and trends in sea ice in Canada during the summer season.

The Snow cover indicators provide information on spring snow cover extent and annual snow cover duration in Canada.

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[51] Alam, H. (2025) Nova Scotia feeling the impacts of drought from climate change. Retrieved on December 10, 2025.

[52] Cadel, A. (2024) Wetlands and Climate Change in Southwest Nova Scotia - Climatlantic. Retrieved on December 10, 2025.

The Temperature change in Canada indicators report yearly and seasonal surface air temperature departures in Canada.

The Water use in Canada indicator provides information on the volume of water withdrawn, consumed, and returned by 7 key sectors (thermal power generation, manufacturing, mining, oil and gas, agriculture, commercial and institutional, and residential) as a measure of the sustainability of Canada’s freshwater supplies.

Data sources and methods

Data sources

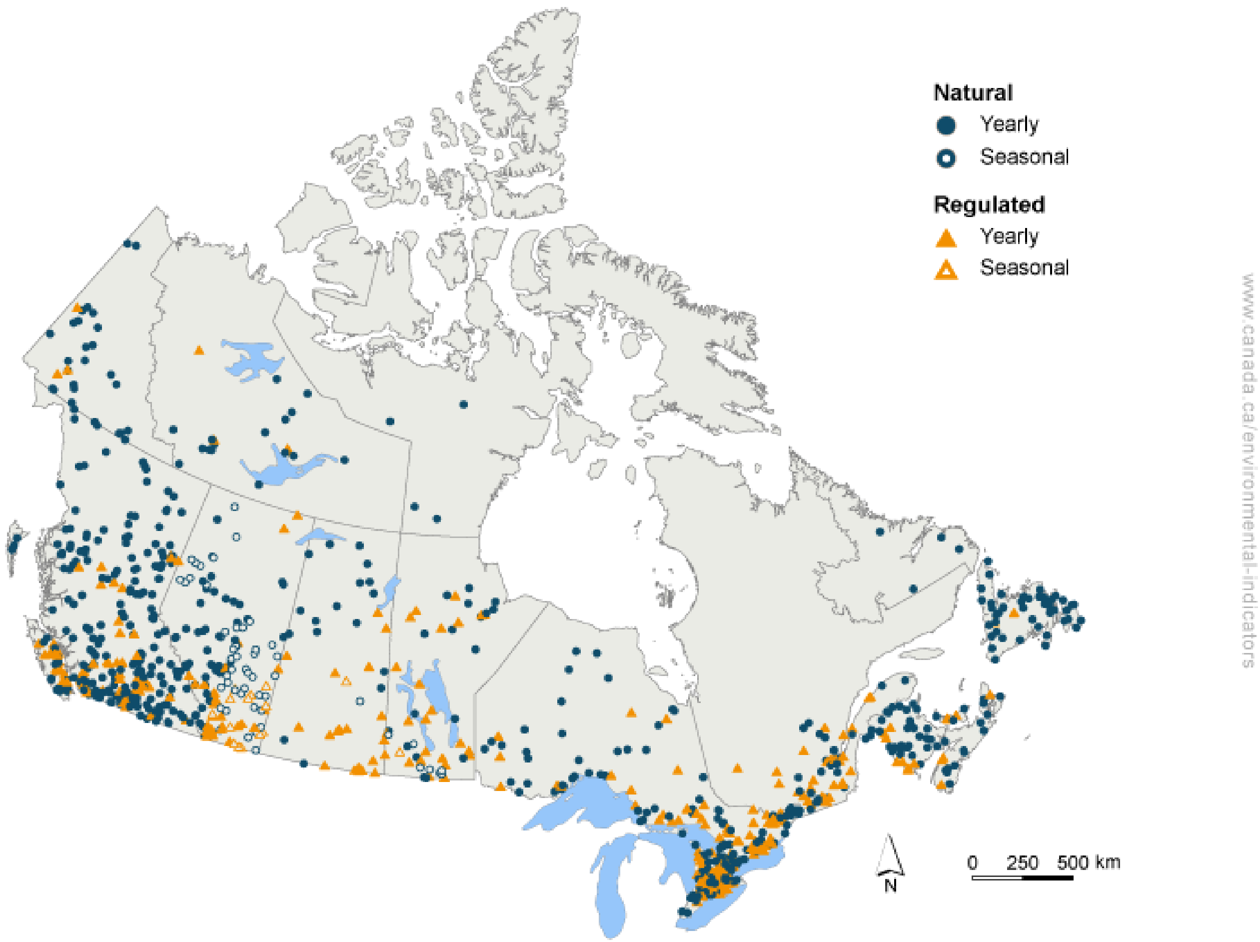
Water flow data across Canada for 1974 to 2023 are taken from the Water Survey of Canada's National water data archive (HYDAT).

There is a time lag of about 2 years between the last year reported and the publication of the indicators. This time lag is due to several factors, including the time required to verify the raw data, compile the data at the national level from all partners, and analyze, review and report the data.

More information

For 2023, the national indicators include data from 970 continuous (yearly) and seasonal monitoring stations across Canada. At continuous monitoring stations, water flow data are collected 365 days per year. In general, seasonal monitoring stations operate for 6 or 7 months per year, typically March to October, but may operate for any other period depending on the purpose of the station. Both natural and regulated rivers and all basin sizes were included.

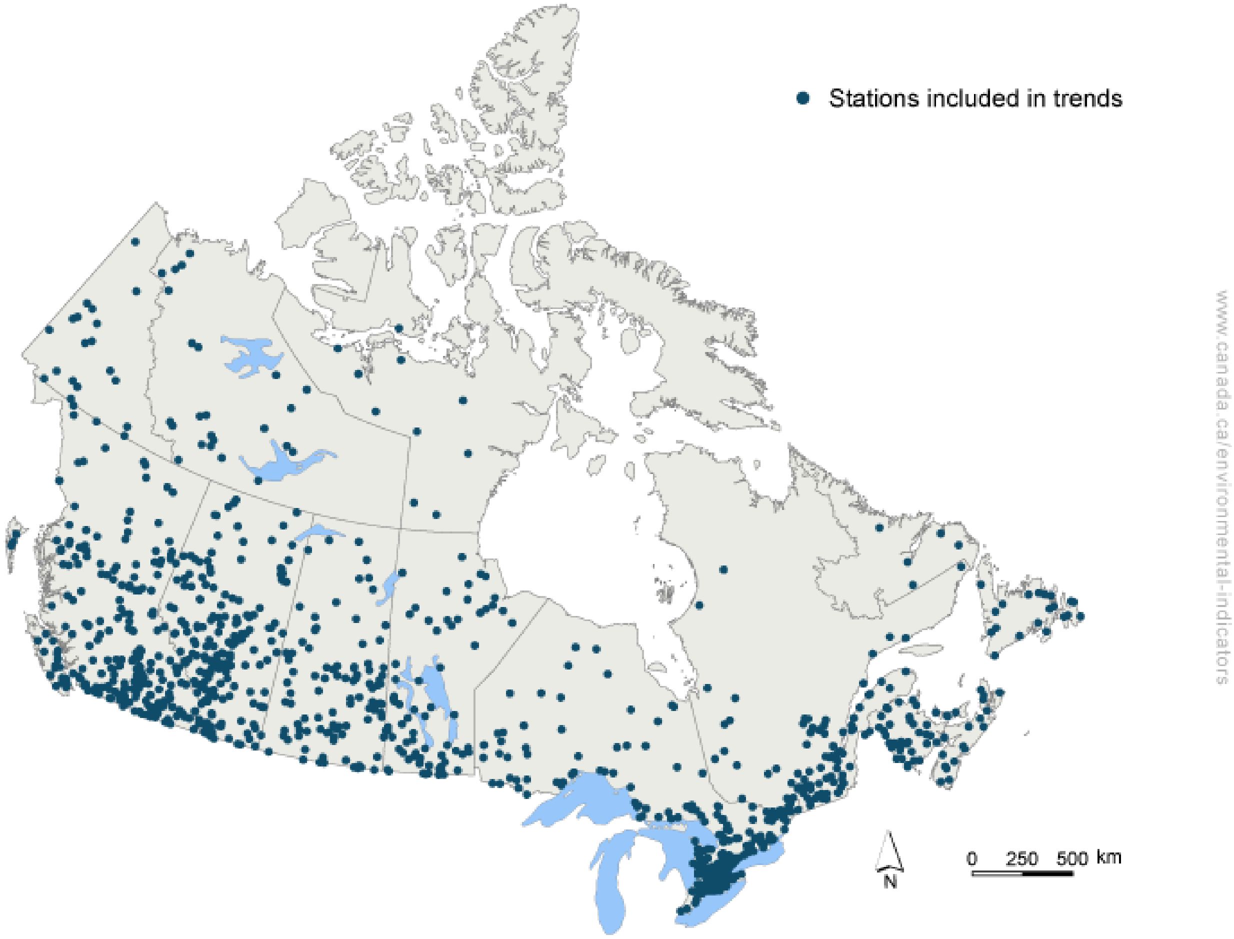
Figure 6. Location of water quantity monitoring stations used for the national indicators, 2023



Note: Natural stations are those where human activity upstream of the station has little impact on water flow. Regulated stations have water withdrawals, dams, diversions or other structures upstream that may change the quantity of water in the river. Water quantity data at seasonal stations are only collected for part of the year.
Source: Environment and Climate Change Canada (2025) Water Survey of Canada.

The trends in annual water quantity include data from 883 flow stations (natural and regulated) across Canada from the Water Survey of Canada's National water data archive (HYDAT). The trends in the number of high flow days and the trends in the number of low flow days indicators include data from 520 and 613, respectively, of 1,027 flow stations across Canada classified as part of the Reference Hydrometric Basin Network (RHBN), a subset of HYDAT (Figure 7). The RHBN is a set of stream gauge stations with long records and minimal human impacts that are considered appropriate for studying the potential impacts of climate change on water quantity in Canada.

Figure 7. Location of water quantity monitoring stations used for the trends indicators, 1974 to 2023



Note: All stations with sufficient data to calculate trends are included on this map, though each station did not necessarily have sufficient data to calculate all 3 trend indicators.
Source: Environment and Climate Change Canada (2025) Water Survey of Canada.

Data completeness

Water flow data from each monitoring station are managed by their respective Environment and Climate Change Canada regional offices and stored in the federal HYDAT database. The data used in the indicators are subject to quality assurance and quality control procedures to ensure they adhere to Environment and Climate Change Canada's national standards.

There are gaps in the water flow datasets due to periodic instrument failure. Where possible, regional offices use standardized protocols to estimate flow data to fill these gaps. Estimated flow values are considered to be reliable and are included in the calculation of the water quantity indicators. Only when data cannot be estimated are they considered missing.

For the national annual water quantity indicators (Figures 1 and 2), a complete dataset was defined as having data available for at least 80% of the year:

- 292 days out of 365 for continuous stations, and
- 174 days out of 217 for seasonal stations (typically run for approximately 7 months)

For the 50-year trend indicators, from 1974 to 2023 (Figures 3, 4 and 5), the following conditions had to be met for a station to be included in the trend calculations:

- valid data starting within the first 6 years of reference period (for example, starting in or before 1979),
- no gaps of more than 10 years in the data record,
- valid data for at least 30 years in the 50-year period from 1974 to 2023, and
- at least 20 years of sufficient data within the baseline period (1991 to 2020) for comparison

To be considered a valid year, a station must have at least 90% data coverage (329 days) for quantity trends (Figure 3) and 150 days of coverage for high and low flow trends (Figure 4 and 5). Additionally, for low flow trends, intermittent watercourses (stations with flowing water only during certain times of the year) must have at least 11 periods of consecutive zero flow during the 30-year normal period.

Stations not meeting these criteria for a year were not included in the calculation of the indicators for that specific year, but did not automatically exclude the station unless it did not meet the other data requirements.

Data timeliness

Data for the indicators were taken from the October 14, 2025 version of HYDAT.

Methods

National water quantity

The water quantity at a station is classified as low, normal or high by comparing annual water flow values for each station to the 30-year normal values for that station. Specifically, annual water flow for each monitoring station was calculated by adding the daily water flows for stations over an entire year and then dividing the annual totals by the area of the contributing watershed. The resulting annual value was then compared to typical water flows over a 30-year normal period from 1991 to 2020 for the station to determine the station's status for the year. For the national indicators, the percentage of stations in each category was calculated and then presented for each year from 2009 to 2023 as well as the status for each station across Canada in 2023.

Trends in annual water quantity

For the trends in annual water quantity indicator, annual water quantity for each monitoring station was also calculated by adding the daily water flows for stations over an entire year and then dividing the annual totals by the area of the contributing watershed. Dividing the totals by the watershed area allows for direct comparisons to be made between watersheds of different sizes. The resulting annual water quantity values, expressed in millimetres, can be thought of as the volume of annual flow per contributing area. A Mann-Kendall test was used to assess whether there was a statistically significant increasing or decreasing trend in the annual water quantity at a station over the 1974 to 2023 period. If there was no positive or negative trend, a Wald-Wolfowitz test was used to determine if the annual water quantity over the 1974 to 2023 period was stable.

Trends in the number of high flow days

For the trends in the number of high flow days indicator, the daily flow values for a station were compared to a threshold set at the 95th percentile of all daily flows during a 30-year normal period from 1991 to 2020 for that station to determine days with very-high water flows. A negative binomial test or Hurdle-negative binomial test was used to determine if there was a trend in the number of days with very-high flow over the 1974 to 2023 period. If there was not a positive or negative trend, a Wald-Wolfowitz test was used to determine if the number of days with very-high flow over the 1974 to 2023 period was stable.

Trends in the number of low flow days

For the trends in the number of low flow days indicator, the summer daily flow values for a station were compared to a threshold determined by the type of stream at the station. Summer was defined as the period between peak spring flow (presumably due to snowmelt) and October 1, unless peak spring flow occurred before May 1 in which case the period was May 1 to October 1. Two (2) stream types were defined:

- perennial streams, where water typically flows all summer long. For these streams, the threshold was set at the 1-in-5-year, 7-day average minimum flow during the 30-year normal period and low flows were defined as those when flows dipped below the threshold. Additional criteria for very-low flow days were set using the streamflow deficit method[53] to eliminate short periods with flows near the threshold; specifically, low flow events were combined if they occurred less than 5 days apart and the volume of water resulting from the period between these events was not enough to cover the water deficit associated with these low flow events. Events were also eliminated if they lasted less than 5 days;

- intermittent streams, where the stream typically runs dry for a period of the summer. For these streams, the threshold was set at the 90th percentile of dry period duration following the consecutive dry period method[54] and any days with zero flow in excess of the threshold were counted as low flow days. Streams were classified as intermittent if, during the summers of the 30-year normal period: more than 25% of the 7-day average minimum flow values were 0, the 1-in-5-year low flow was less than 0.001 m^3/s, or it was not possible to calculate a 1-in-5 year return frequency low flow.

A negative binomial test or Hurdle-negative binomial test was used to determine if there was a trend in the number of days with very-low flow over the 1974 to 2023 period. If there was no positive or negative trend, a Wald-Wolfowitz test was used to determine if the number of days with very-low flow over the 1974 to 2023 period was stable.

More information

Data extraction

Basic station information and water flow data were extracted from HYDAT according to input parameters, such as record length, data type and drainage area. Scripts in the R computer programming language[55] were used to extract data from HYDAT and calculate the indicators.

Categorizing water quantity at a monitoring station for the national indicators

Water quantity at a monitoring station is classified based on historical data recorded at Water Survey of Canada hydrometric stations. To start, frequency distributions for annual water quantity were calculated using water flow data collected from 1991 to 2020 at each monitoring station. This 30-year normal reference period is used to provide a summary of the hydrologic characteristics of a station, while maximizing the number of stations included in the indicators.

Water quantity categories were defined from the frequency distributions:

- low < 15th percentile
- 15th percentile ≤ normal ≤ 85th percentile
- high > 85th percentile

Annual water quantity records for 2009 to 2023 were categorized as low, normal or high by comparing the measured value to the percentiles calculated for the corresponding station over the normal reference period. Accordingly, a station described as having a low water flow in 2023, for example, had a measured value ranking among the lowest 15% of the values observed from 1991 to 2020.

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[53] World Meteorological Organization (2008) Manual on low-flow estimation and prediction. ISBN: 978-92-63-11029-9. Retrieved on November 3, 2025.

[54] Van Huijgevoort MHJ et al. (2012) A generic method for hydrological drought identification across different climate regions. Hydrology and Earth System Sciences. 16(8): 2437-2451. doi: 10.5194/hess-16-2437-2012. Retrieved on November 3, 2025.

[55] R Core Team (2019) R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Retrieved on November 3, 2025.

Table 1. Number of water quantity monitoring stations used in the national indicators grouped by province and territory, 2023

Province or territory	Number of stations
Newfoundland and Labrador	51
Prince Edward Island	6
Nova Scotia	18
New Brunswick	41
Quebec	55
Ontario	245
Manitoba	50
Saskatchewan	40
Alberta	130
British Columbia	281
Yukon	29
Northwest Territories	20
Nunavut	4

Note: Stations located in the United States are counted in the adjacent territory or province, to which the water flows.

Calculating the trends in annual water quantity, the trends in the number of high flow days, and the trends in the number of low flow days indicators

A Mann-Kendall test was used to assess the presence (or the absence) of consistently increasing or decreasing trends in annual water quantity over the 1974 to 2023 period. This is a statistical process commonly used to analyze data collected over time. The slope of the trend line is based on the Theil-Sen Estimator[56] which calculates the median of the slopes through all pairs of points and can robustly handle most point distributions. For the resulting trends expressed in millimetres, a positive value indicates that the annual average water quantity at a station has increased over the period, a negative value indicates a decrease, and a zero value indicates no statistically significant change over the period. If no positive or negative trend was detected with the Mann-Kendall test, a Wald-Wolfowitz stationarity test was used to determine if the values at the station were stable over time.

In the case of the number of high and low flow days indicators, to assess the presence of trends, Negative Binomial, Hurdle-Negative Binomial and Wald-Wolfowitz tests were used. These tests work in cases where the same indicator value occurs in multiple years, as is the case for the number of high or low flow days for many stations. The Negative Binomial test was used for stations with less than 3 years with zero high or low flow days and the Hurdle-Negative Binomial test was used for stations with 3 or more years with zero high or low flow days. If no positive or negative trend was detected with the first 2 tests, a Wald-Wolfowitz stationarity test was used to determine if the values at the station were stable over time. The indicators are meant to show the trends in the prevalence of very-high or very-low flow

[56] Theil H (1950) A rank-invariant method of linear and polynomial regression analysis. I, II, III, Nederlandse Akademie van Wetenschappen, Proceedings, 53: 386 to 392, 521 to 525, 1397 to 1412., Sen Pranab Kumar (1968) Estimates of the regression coefficient based on Kendall's tau. Journal of the American Statistical Association 63 (324): 1379 to 1389, doi:10.2307/2285891.

conditions across Canada over the 1974 to 2023 period and may not necessarily represent actual recorded or reported flood or drought events.

Trends calculated are assessed for potential outliers[57] using Rosner's test.[58] Outlier trends occur mostly at stations when over the 50-year period, there are very few years with low flow days (10% or less) or there was a sharp change in the number of low flow days (as determined using Pettitt's test).[59] Confirmed outlier trends were eliminated from further calculations.

The trends for the high flow days and low flow days is represented in the maps considering the number of days for each station considered in the calculation. The data in the Annex section represents the percentage of those stations in high flow days or low flow days according to the province or the territory.

Interpolation

Kriging was used to interpolate data from stations locations onto a surface map. A semi-variogram model was created to describe the influence of the station value on the areas around it and used to estimate values in areas with no data. A minimum of 8 data points within a 500 kilometre radius are necessary to estimate a value. In certain areas of the country such as the North of Quebec, there was not enough data points to successfully perform kriging. As a result, no trend indicator is shown on the maps for these regions. The kriging operation smooths the data so that a small percentage of very-high and very-low values do not appear as extreme on the map. For example, the trends in annual water quantity values vary from -7.1 to 8.5 mm/year, yet the kriged data ranges from -1.7 to 2.7 mm/year. Overall, 93% of the original data fall within the range of the kriged data.

Recent changes

The 50-year trend analysis period was rolled forward from 1970 to 2021, to now 1974 to 2023 in this report. Similarly, the annual snapshots of water quantity have been rolled forward from 2001 to 2021, to now 2009 to 2023 for relevancy.

The methodology to calculate the National water quantity at monitoring stations was revised to compare annual water quantity with the 15th and 85th percentiles of typical annual flow during the 30-year normal reference period. Previous calculations compared the most frequently observed flow condition in a given year with the 25th and 75th percentiles of typical water quantity. Even though both methods produce similar results, the percentiles used are different and this method has a more rigorous accounting for all the water flowing at each station for the year.

The methodology to determine trends has been augmented by a stationarity test to identify those stations where values are stable over time. Previously these stations had been classified as uncertain.

The 30-year reference period for current calculations is 1991 to 2020 because these are the 3 most recent decades for which data is available. In previous publications, the 30-year reference period was 1981 to 2010 since they were the most recent data available then.

Coverage of the trends analysis for the mapping presentation were also updated by using different assumptions and interpolation methods. Currently, the surface maps are interpolated using inverse distance weighing, which preserve spatial variability when there is spatial autocorrelation in data. As a result, the north of the country does not have enough data points to preserve spatial variability and cannot be calculated for this region.

Caveats and limitations

Some short duration events, including some floods, may not influence the final water quantity classification of a station. Changes to seasonal flow patterns will also affect final classifications.

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[57] Outliers are values much higher or much lower than would be expected given all the other values.

[58] Rosner, B. (1983) Percentage Points for a Generalized ESD Many-Outliers Procedure. Technometrics. 25(2): 165-172.

[59] Pettitt, A.N. (1979) A non-parametric approach to the change point problem. Journal of the Royal Statistical Society Series C, Applied Statistics. 28: 126-135.

The status of water quantity assessed by the present indicators is a reflection of the 30-year time period (1991 to 2020) used for the calculations and does not necessarily reflect longer-term trends at the station. Trend maps are only representative of the time period analyzed (1974 to 2023) and may be influenced by long-term climatic fluctuations.

Water flow data collected at a monitoring station are representative of the average conditions of the upstream drainage area. Professional judgment is used to determine whether there were enough stations to describe water quantity in a drainage region.

More information

Extreme short-term events may not be detected with the indicators, since the focus is on frequency of observations in different categories through the year. The trends in the number of low flow days indicator has been added to help characterize this important aspect of water quantity.

Water quantity generally follows a predictable seasonal pattern with natural, year-to-year variability. The indicators compare daily values to the 30-year normal and assume that water quantity is approximately the same from one year to the next for the same calendar day. A shift in the predictable seasonal pattern (the hydrograph) for one year will influence the results.

Most water quantity monitoring stations in Canada are located in populated areas and do not represent the country's entire geographic extent or all its watersheds.

While 30 years represent a long time series for water quantity data, it represents a relatively short historical time frame for a given river and does not account for all natural variability in a river system.

The number of water quantity monitoring stations included in these indicators fluctuates from year to year because stations may be removed as monitoring networks are optimized. Whether or not the data have been verified and uploaded into HYDAT by the time the data are extracted to calculate the indicator also influences whether the station is included in the calculation that year.

Resources

References

Environment and Climate Change Canada (2025) Real-time Hydrometric Data. October 14, 2025 version. Retrieved on November 3, 2025.

Environment and Climate Change Canada (2025) Water Survey of Canada. Retrieved on November 3, 2025.

Statistics Canada (2003) Standard Drainage Area Classification. Retrieved on November 3, 2025.

Related information

Canada's changing climate report: Changes in freshwater availability across Canada

El Niño

La Niña

Large-scale climate oscillations influencing Canada

Ratio of surface freshwater intake to water yield

Annex

Annex A. Data tables for the figures presented in this document

Table A.1. Data for Figure 1. Water quantity at monitoring stations, Canada, 2009 to 2023

Year	Total number of stations	High quantity (percentage of stations)	Normal quantity (percentage of stations)	Low quantity (percentage of stations)
2009	1,112	16	65	18
2010	1,117	11	61	27
2011	1,110	40	57	3
2012	1,120	14	63	23
2013	1,118	24	69	7
2014	1,128	27	68	5
2015	1,120	7	71	22
2016	1,110	9	83	8
2017	1,095	23	73	4
2018	1,091	14	76	10
2019	1,076	17	65	18
2020	1,056	31	62	7
2021	1,048	12	60	28
2022	1,024	17	71	11
2023	970	10	61	30

Note: Percentages may not add up to 100 due to rounding. 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 2020. For more information, please see the Data sources and methods section.
Source: Environment and Climate Change Canada (2025) National Water Data Archive (HYDAT).

Table A.2. Data for Figure 3. Annual rate of change in water quantity at monitoring stations, Canada, 1974 to 2023

Province or territory	Total number of stations	Increasing trend (percentage of stations)	Stable trend (percentage of stations)	Decreasing trend (percentage of stations)	Uncertain (percentage of stations)
Newfoundland and Labrador	23	43	39	13	4
Prince Edward Island	4	75	25	0	0
Nova Scotia	18	61	17	11	11
New Brunswick	36	72	28	0	0
Quebec	73	55	26	15	4
Ontario	211	42	38	19	1
Manitoba	53	81	9	6	4
Saskatchewan	61	57	26	13	3
Alberta	111	30	41	27	3
British Columbia	246	40	38	15	7
Yukon	18	94	6	0	0
Northwest Territories	23	52	17	17	13
Nunavut	5	80	20	0	0

Note: Percentages may not add up to 100 due to rounding. The indicator is based on a statistical analysis of annual water quantity at monitoring stations over the 1974 to 2023 period. Annual water quantity for each monitoring station was determined by adding the daily water flows for stations over an entire year and then dividing the annual totals by the area of the contributing watershed for a depth in millimetres. A statistical analysis was then applied to the resulting values to determine if there was a trend. Positive trend values indicate that the annual water quantity at a station has increased over time, negative values indicate a decrease, and zero values indicate that the annual water quantity has remained the same over time. For more information, please see the Data sources and methods section.
Source: Environment and Climate Change Canada (2025) National Water Data Archive (HYDAT).

Table A.3. Data for Figure 4. Annual rate of change in the number of high flow days at monitoring stations, Canada, 1974 to 2023

Province or territory	Total number of stations	Increasing trend (percentage of stations)	Stable trend (percentage of stations)	Decreasing trend (percentage of stations)	Uncertain (percentage of stations)
Newfoundland and Labrador	23	13	57	22	9
Prince Edward Island	1	0	100	0	0
Nova Scotia	10	40	50	10	0
New Brunswick	26	15	69	15	0
Quebec	38	11	63	24	3
Ontario	68	26	56	16	1
Manitoba	30	47	40	7	7
Saskatchewan	44	64	23	0	14
Alberta	117	13	64	18	5
British Columbia	133	19	63	12	6
Yukon	15	7	80	7	7
Northwest Territories	14	57	36	7	0
Nunavut	1	0	0	0	100

Note: Percentages may not add up to 100 due to rounding. The indicator is based on a statistical analysis of the annual number of high flow days at monitoring stations over the 1974 to 2023 period. It shows the prevalence of high flow conditions (above the 95th percentile of all daily flow values for a monitoring station compared to a 30-year normal period from 1991 to 2020). This may be linked to flooding events but does not necessarily represent actual recorded or reported events. Positive values indicate that the number of days with very-high flows over the 1974 to 2023 period have increased, negative values indicate a decrease, and zero values indicate that the number of high flow days have remained the same. For more information, please see the Data sources and methods section.
Source: Environment and Climate Change Canada (2025) National Water Data Archive (HYDAT).

Table A.4. Data for Figure 5. Annual rate of change in the number of low flow days at monitoring stations, Canada, 1974 to 2023

Province or territory	Total number of stations	Increasing trend (percentage of stations)	Stable trend (percentage of stations)	Decreasing trend (percentage of stations)	Uncertain (percentage of stations)
Newfoundland and Labrador	23	43	4	43	9
Prince Edward Island	1	0	0	100	0
Nova Scotia	11	45	27	18	9
New Brunswick	26	62	19	15	4
Quebec	48	50	12	31	6
Ontario	85	49	15	26	9
Manitoba	46	26	15	46	13
Saskatchewan	65	28	12	48	12
Alberta	120	41	14	40	5
British Columbia	142	67	16	14	3
Yukon	16	25	19	56	0
Northwest Territories	21	24	24	38	14
Nunavut	9	33	22	44	0

Note: Percentages may not add up to 100 due to rounding. The indicator is based on a statistical analysis of the annual number of low flow days at monitoring stations over the 1974 to 2023 period. It shows the prevalence of very-low flow conditions during the summer (when daily flow values fall outside a threshold of all daily flow values for a monitoring station compared to a 30-year normal period from 1991 to 2020), which may be linked to drought events but does not necessarily represent actual recorded or reported events. Positive values indicate that the number of days with very-low flows over the 1974 to 2023 period have increased, negative values indicate a decrease, and zero values indicate that the number of days have remained the same. For more information, please see the Data sources and methods section.
Source: Environment and Climate Change Canada (2025) National Water Data Archive (HYDAT).