Ottawa River Regulation Planning Board

Commission de planification de la régularisation de la rivière des Outaouais

2019 Spring Flood – Questions and Answers

Message from the Ottawa River Regulation Planning Board

The 2019 spring flood was very challenging, affecting thousands of people's lives. Many concerned citizens have reached out to the Planning Board seeking answers to their questions about this exceptional flooding event and the Board's role. We also heard requests for specific actions that will further reduce the impact of floods in the Ottawa River.

In Ontario and Québec, municipal, provincial and federal governments all take part in the protection of the residents against flooding, which takes different forms. The Board's role in this undertaking is often misunderstood. In order to respond to these enquiries, we are providing a series of answers to questions that were often asked during the spring flood of 2019. In the weeks to come, we will continue our review of the 2019 spring flood and will be preparing a summary document similar to the document[1] we had prepared following the 2017 flood.

Ottawa River Regulation Planning Board

[1] Document available at http://www.ottawariver.ca/docs/2017_Spring_Flood_Summary.pdf.

For any questions regarding the Planning Board,
please communicate with the Ottawa River Regulation Secretariat :

Ottawa/Gatineau : (819) 994-9049 Elsewhere : 1-800-778-1246

Secretariat@ottawariver.ca

Note: The terms *drainage basin, freshet, reservoir, runoff, run-of-river dam, tributary,* and *watershed* are described in a glossary at the end of this document.

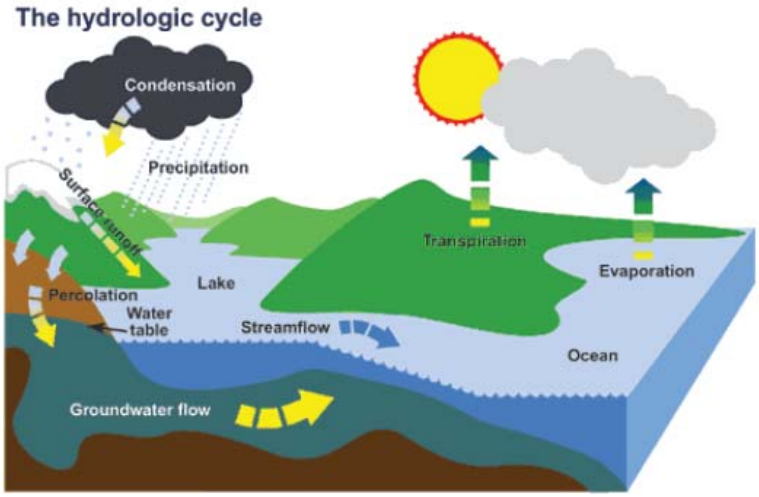
1- Question: What causes flooding? Can too much snow and rain really cause all this water to flow into the river?

Answer: Flooding occurs when the volume of water flowing in a river or stream exceeds the capacity of the channel. Snowmelt runoff floods are the most common type of flooding in Canada. *Government of Canada – Snowmelt Runoff* https://www.canada.ca/en/environment-climate-change/services/water-overview/quantity/causes-of-flooding.html#snowmelt).

Explanation: Numerous factors affect the volume of water flowing in a river and, therefore, the potential for flooding. The most important factors are the amount and type of precipitation, the nature and condition of the drainage basin (or watershed), and climate. During the Canadian winter, most of the precipitation is simply stored as snow or ice on the ground. During the spring melt, large quantities of water are released and can combine with rainfall, which can lead to heavy spring flow and flooding. This is called **freshet**.

In spring when the soil is saturated and still partly frozen, the rapid melting of snow means that there's little opportunity for the water to be absorbed. A large portion of the water contained in the snow ends up in the river. In addition, when rainfall occurs along with the snow melt, a larger portion of the water contained in the snow combines with rainfall and runs off on the ground surface to low lying areas and streams.

Overall, a land area twice the size of New Brunswick drains to the Ottawa River. As an example, assuming that 50 mm of rainfall were to be received over much of the watershed and that half of this rainfall would run off to the river, this would represent an additional volume of 3,650 million cubic metres of water into the river. That's more water than needed to fill 1,000,000 olympic-sized swimming pools.



(Figure credit: Environment and Climate Change Canada)

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2 - Question: Why is the Ottawa River Regulation Planning Board not preventing or stopping the flooding?

Answer: In years where spring runoff is significant, it is not possible to prevent flooding.

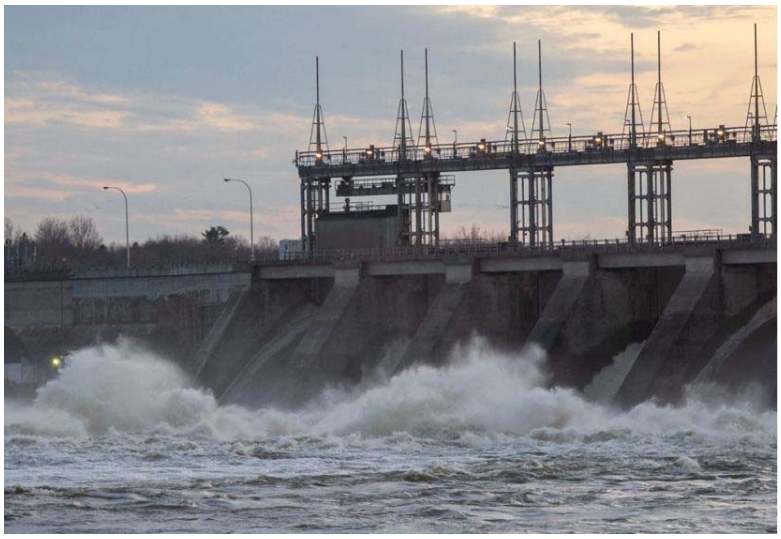
Explanation: The primary way to prevent or reduce flooding is to store spring melt or runoff in the principal reservoirs. By storing or keeping water in these reservoirs, the volume of water (or river flow) is reduced downstream. The principal reservoirs in the Ottawa River basin are large enough to hold on to approximately 40% of the average spring runoff. By using the principal reservoirs in this way, it is possible to prevent significant downstream flooding in most years.

Flooding occurs on the main stem of the Ottawa River when:

- *The spring runoff greatly exceeds the size of the principal reservoirs* — Each year, the principal reservoirs are emptied over the course of winter and then filled during the spring period of several weeks and sometimes months. Once full, principal reservoirs must pass what flow they receive to downstream areas.
- *There is significant spring runoff in areas where there are no principal reservoirs* — Facilities on the Ottawa River in the central and southern parts of the watershed have very little ability to store spring runoff. During periods of high flows these facilities operate as run-of-river dams[2]. The storage

[2] Des Joachims generating station is a principal reservoir that is operated like a run-of-river dam during high flow

volumes in the central and southern parts of the watershed are very small compared to the overall flow volume during the freshet period. For instance, if the dams at those facilities were to be completely closed when the freshet is at its peak, they would fill up and worsen upstream flooding within hours. To significantly reduce downstream flooding, a facility needs to be able to store water upstream over a period of several days (sometimes weeks) depending on river conditions.



Carillon Dam located in the southern portion of the Ottawa River on April 25, 2019

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3 - Question: **What is the goal of the Ottawa River Regulation Planning Board?**

Answer: The Planning Board's mandate is to ensure the integrated management (or operation) of the flow from the thirteen principal reservoirs of the Ottawa River Basin. In practice this means that operators of the principal reservoirs work together to ensure that available storage in the principal reservoirs is used to minimize downstream flooding. It also ensures that relevant hydrological information, for example forecasts of river flows along the Ottawa River are made available to government organizations and the public.

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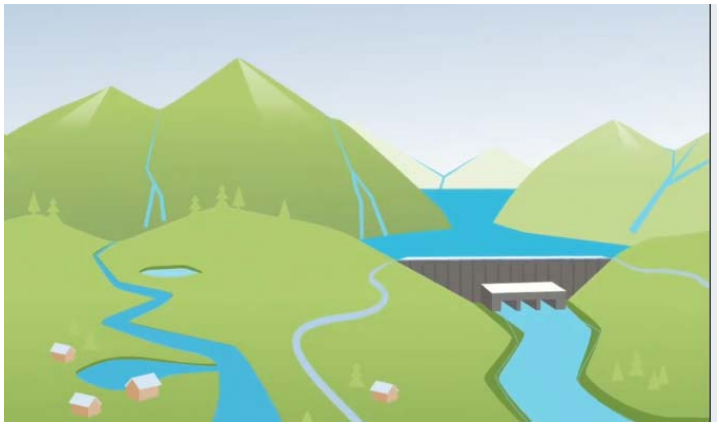
periods for reasons explained in FAQ no. 5.1 – http://www.ottawariver.ca/faq.php#q5.1



Water is stored in principal reservoirs to reduce flooding downstream
(Figure credit: Hydro-Québec)

Explanation: The term "integrated management" describes the process by which the thirteen principal reservoirs in the Ottawa River basin are cooperatively operated to maximize the benefit of the limited reservoir storage available. The Planning Board ensures the integrated management of the flow from the principal reservoirs to minimize flood and drought impacts along the Ottawa River, its major tributaries, and in the Montréal Region, while maintaining beneficial water uses in the basin. The Planning Board also ensures that relevant hydrological information such as forecasts of river flows along the Ottawa River are made available to the public and government organizations, especially provincial agencies given that the preparation and issuance of flood-related messages along the Ottawa River are a provincial responsibility.

The principal reservoirs that are subject to integrated management under the policies of the Planning Board are operated by the four agencies that comprise the Ottawa River Regulating Committee (the Regulating Committee). The intent of "integrated management" is that by sharing hydrological information and establishing agreement on appropriate regulation strategies, the best possible use of the limited reservoir storage will be accomplished cooperatively by these four agencies.

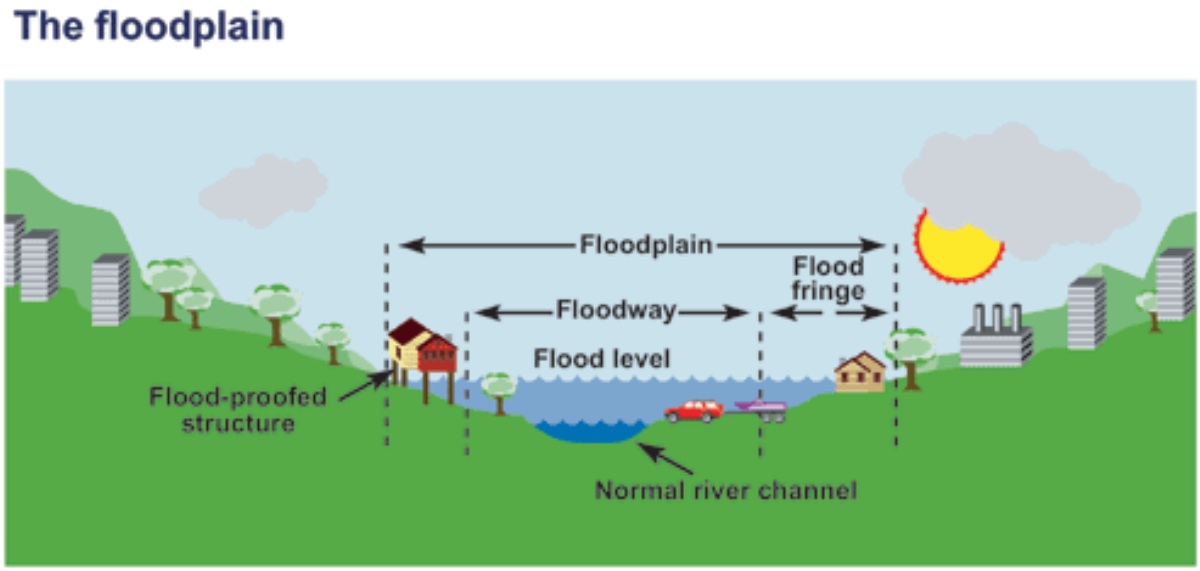
The Ministry of Natural Resources and Forestry of Ontario is an associate member of the Regulating Committee. It contributes important hydrometeorological information (such as measurements of snow depth, precipitation and stream water levels) and plays a key role is disseminating information in Ontario.

The Planning Board role is often misconstrued to be that of a "control board," which it is not. The Planning Board does not have legal authority over the decisions of the operators of the principal reservoirs. Each operator remains responsible for the operational strategies and decisions at its reservoirs.

The locations of the reservoirs are shown on the Planning Board website at http://www.ottawariver.ca/reservoir-levels-discharges.php .

4 - Question: How is integrated management of the principal reservoirs providing protection against flooding?

Answer: The integrated operation of the principal reservoirs protects residents along the Ottawa River and its major tributaries against flooding because it allows for optimal use of the available storage to mitigate flooding downstream. Flooding extent and duration is always reduced and, in many years, eliminated. In addition, providing timely flow forecasts to responsible authorities enables flood preparedness and response.



(Figure credit: Environment and Climate Change Canada)

Explanation: The principal reservoirs that are used to mitigate flooding can store a large portion of the spring runoff, which is sufficient in most years to prevent flooding. In years where spring flow is significantly larger than the capacity of the principal reservoirs or when there is significant spring runoff in areas where there are no principal reservoirs, the river flows out of its normal river channel and it is not possible to prevent damaging flooding. However, the amount of storage available still plays a significant role in preventing even higher flood levels from occurring.

In Ontario, Conservation Authorities and District Offices of the Ministry of Natural Resources and Forestry issue flood related messages and information to municipalities and other key agencies involved in flood

preparedness and response. Current flood related messages can be viewed on-line on the individual conservation authority websites and on the provincial flood webpage: https://www.ontario.ca/flooding.

In Québec, the Centre des opérations gouvernementales du Québec and the Sécurité civile collaborate with municipalities to protect residents. Monitoring of flood conditions can be viewed at https://geoegl.msp.gouv.qc.ca/adnv2/.

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5 - Question: **Who regulates water levels on the Ottawa River?**

Answer: Given the multi-jurisdictional nature of the Ottawa River (shared between Ontario, Québec and Canada), there is no one agency responsible for the regulation of water. A group of agencies, each responsible for their own operations, comprise the Ottawa River Regulating Committee and work together with the purpose of integrating the management of the flow from the thirteen principal reservoirs in the Ottawa River basin. During the spring, the goal of this management is to minimize the impacts of flooding as much as possible.

Explanation: The Ottawa River Regulation Planning Board is not a control board. It is a board created by governments for the purpose of ensuring that the flows from the principal reservoirs are managed in a coordinated way by the four agencies that operate them. These agencies are Ontario Power Generation, Hydro-Québec, the government of Canada[3] and the government of Québec[4]. The Ottawa River Regulation Secretariat, composed of two staff engineers, support the work of the Regulating Committee and the Planning Board and communicate with the media, public and government agencies on water flow and level conditions on the Ottawa River.

Each of the four agencies remains responsible for managing its facilities and principal reservoirs. Water management requirements are subject to provincial and federal legislation and regulations. These water management requirements, which consist of respecting statutory and environmental levels and discharges do not apply to every part of the river nor every possible situation. For instance, in river sections between Lake Timiskaming and the Deux-Montagnes area, the peak water levels reached in flood-prone areas during the freshet are the result of natural temperatures, precipitation and local natural restrictions in the river. These peak levels may exceed statutory maximum levels in river sections that are subject to such regulation if river flows become high enough.

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[3] Public Services and Procurement Canada
[4] Ministère de l'Environnement et de la Lutte contre les changements climatiques of Québec

6 - Question: How are facilities located between Lake Timiskaming and the Deux-Montagnes area managed during periods of high flows?

Answer: Facilities on the Ottawa River between Lake Timiskaming and its outlet at Deux-Montagnes are considered to operate as run-of-river dams (or facilities) during high flows (refer to the glossary).

Explanation: These facilities cannot reduce the levels and flows in the river given that they have minimal storage ability. At these facilities, before high flow periods occur, the level at the facility is adjusted to ensure that upstream, naturally occurring, flooding will not be made any worse by the presence of the facility as the river flow increases further. Once the level is adjusted, the facility passes any water that arrives at the dam, which is typically described as "passing inflow". When passing inflows, operators increase the flow through a facility as the arriving river flow increases. A flow increase through a facility is achieved by removing logs from log sluices or opening control gates. Similarly, the flow through a facility is decreased when the flow of the river recedes. A flow decrease through a facility is achieved by replacing logs in log sluices or lowering gates deeper into the water. However, these flow changes do not change the fact that further upstream from the facility the water levels are controlled by the natural features of the river and not the facility. (Refer to Question no. 7)

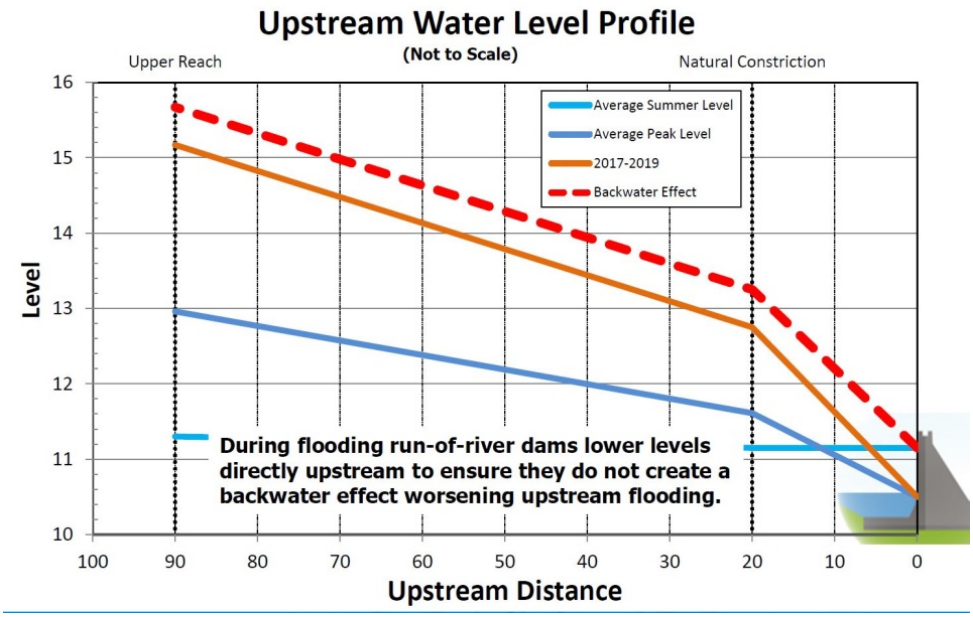
During a period of high flows that cause flooding, the main stem of the river is considered unregulated because water cannot be stored in this section of the river to further reduce the flows and water levels. (Refer to FAQ no. 5 http://www.ottawariver.ca/faq.php#q5 to find out where the few locations on the river are where water can be lowered.)

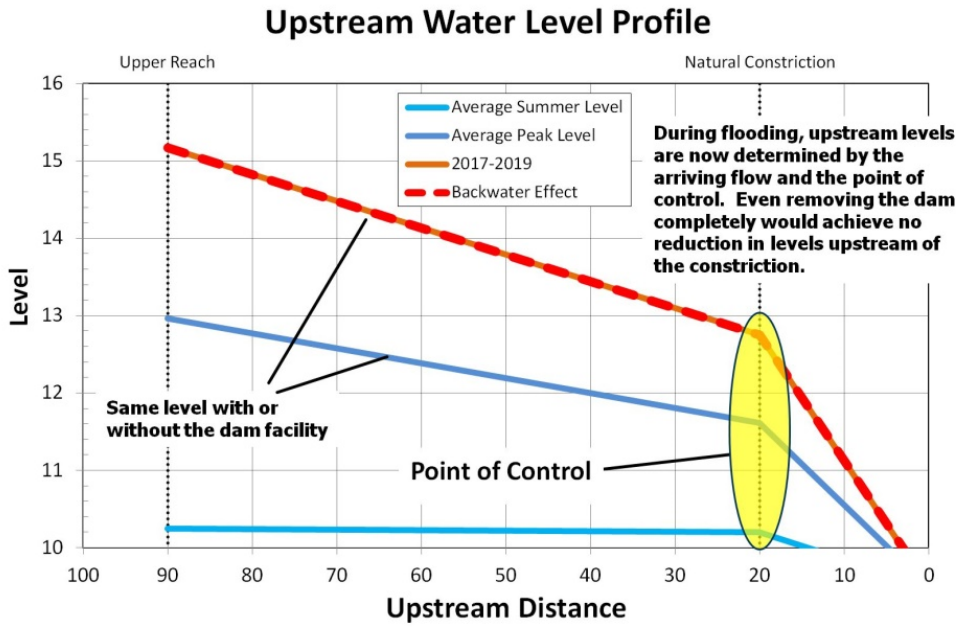
7 - Question: Why are operators of the Carillon, Chats Falls and Bryson dams not making water levels go down when levels are causing flooding between Gatineau (Hull) and Hawkesbury, on Chats Lake, or on Lac Coulonge?

Answer: Operators of Carillon, Chats Falls and Bryson would reduce levels in river reaches located upstream of the facility where there is flooding if they could. However, it is not physically possible to do so. Further opening of gates and log sluices would not make water levels go down. In the flooded area upstream of these facilities, the water levels are determined by the high river flows and the natural constrictions on the river and other features that are upstream from the facility. During high flow periods when flooding is occurring, operators of these three facilities lower the water level just upstream of their facility. The lower level at the facility transfers control of water levels in the flooded area to the natural occurring physical constriction (such as rapids) of the river that existed prior to development.

Explanation: In the spring, water levels on the river increase naturally because the volume of water that flows into the river is increased by the natural runoff from snow melt and rainfall. The natural constrictions

on the river and other features such as islands restrict the flow of water. Under natural flow conditions in a river the water level will increase as the flow increases.





There is no way to force water flow through the river system. It must flow out of the river section naturally, at a speed that is governed by the physical characteristics of the river (e.g. slope of the river bottom, natural narrows such as rapids, width of the river, river-bed and bank type such as rocks or sand). As long as the level at the facility is low enough to maintain control at the upstream natural control section then any further flow increases at the facility will not result in a change of water level on the upstream side of the natural control. If the facility were to reduce the flow, the level would rise and the facility would eventually regain control. The high level at the facility would then result in the level upstream of the natural control point rising higher than would occur prior to development. That is part of why these facilities do not reduce the river flow during periods of high water. Instead, they "pass inflows" as described in Question 6.

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8 - Question: **Why is the water level on the Ottawa River not lowered sooner, for example in February, to prevent flooding?**

Answer: Lowering water levels sooner would not change the degree of flooding in the spring.

Explanation: At the principal reservoirs, water levels are lowered progressively from approximately mid-December to the end of March. The Des Joachims reservoir, which is the smallest of the thirteen principal reservoirs, requires only one month to empty. Des Joachims is emptied every year during the month of March. Water that was stored in the principal reservoirs flows out of the river before natural runoff could cause flooding to downstream locations or local communities. People can follow the emptying and filling of the principal reservoirs every year on the Planning Board's website at http://www.ottawariver.ca/reservoir-levels-discharges.php.

This strategy allows the flows from the principal reservoirs in the Ottawa River to decline to a minimum at the end of March, prior to the beginning of the usual snow melt period. The remaining flow in the river, just before the spring starts, is the total of all of the natural tributaries (Petawawa River, Rouge River, etc.) in the system and is termed the base flow. This base flow varies naturally depending on overwinter conditions and thaw cycles.

Facilities that are operated like run-of-river dams during periods of high flows have small amounts of upstream storage and it requires only a few days to lower the level of the water that is held back above their dams (that is in the river sections immediately upstream of the facility). In the spring, operators follow river condition forecasts very closely in order to prevent higher water levels above their facilities. Facilities that operate as run-of-river during period of high flows lower water levels just before the snow melt runoff causes river flows to increase significantly. This can be observed above some of the run-of-river facilities on the river by the low levels seen just above the facilities. Lowering water levels at the run-of-river facilities in February when the river flows are low would result in low water levels for an extended period of time, possibly a period of ten weeks, and would not reduce the flooding during the spring melt.

9 - Question: How much did dams (reservoirs) factor in to the 2019 flooding?

Answer: The principal reservoirs help reduce flooding in downstream locations by storing large volumes of water and thus reducing flows in the lower river sections, thereby mitigating the downstream flooding. Run-of-river dam facilities located along the length of the Ottawa River do not cause flooding or make naturally occurring flooding any worse (refer to FAQ 5 and 5.1 (http://www.ottawariver.ca/faq.php).

Explanation: During the 2019 spring freshet, the regulation strategy consisted of reducing water flow from the principal reservoirs while southern tributary rivers such as the Petawawa, Dumoine, Coulonge, Mississippi, Petite Nation and Rouge rivers reached their peak and started to recede. It is estimated that by optimizing the use of storage during this year's flooding that peak water levels along the main stem of the river were reduced by a minimum of 40 cm in all locations.

More detailed analysis that provides specific values for reductions in water levels will be provided in the *Summary of the 2019 Spring Flood* document that will be prepared by the Regulating Committee.

10 - Question: Are hydro companies making a profit out of flooding conditions?

Answer: No. Hydropower generation is more efficient with a high water level upstream of the dam and low water levels downstream of it. During a flooding event, the opposite occurs where upstream water levels on the river are lowered to prevent flooding and downstream water levels are naturally high due to high river flows. Also, the freshet period is not associated with high electrical demand as in the winter or in the summer during heat waves.

Explanation: Flood mitigation and public safety are the main focus of water management activities by Hydro-Québec and Ontario Power Generation during the spring melt. Flood conditions are inefficient for producing hydro-power and result in spill through gates and log sluices. Most water does not pass through the turbines and does not produce electricity, providing no benefit to Hydro-Québec or Ontario Power Generation.

11 - Question: **Are communities along the shore of the Ottawa River being sacrificed to protect the Montréal region?**

Answer: No. All communities located downstream of the principal reservoirs benefit from the water that is stored and therefore prevented from flowing downstream during flooding.

Explanation: Flood impacts in the Montréal Archipelago are mitigated by holding (or storing) spring runoff in the principal reservoirs to reduce the peak of flood flows. Since the major reservoirs are located primarily in the northern sectors of the Ottawa River basin and with water flowing north to south, all river sections benefit from water storage during the same flood event. Also, with peak flows occurring at different locations along the length of the river within two to three days of one another the benefits of the use of reservoir storage to reduce peak levels is applicable to the whole length of the river. For instance, on the upper Ottawa River, the town of Mattawa benefits from the presence of the six principal reservoirs located in the Abitibi-Timiskaming area, with flood flows being lower than would have occurred without the presence of the principal reservoirs. Similarly, downstream residents in communities such as Constance Bay on Lac Deschenes benefit from eight principal reservoirs storing water. With two principal reservoirs located on the Gatineau River and three located on the Lievre River that feed into the Ottawa River downstream of Lake Deschenes, the lower reach of the river between Lake Deschenes and the Hawkesbury – Grenville area benefits from the thirteen principal reservoirs, in the same way that the Montréal region eventually does.

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12 - Question: **Over the 2019 Easter long weekend, the Regulating Committee's freshet forecast changed from being an above average spring flood to being a large-flooding event. Why did this occur?**

Answer: Two major rainfall events from Colorado and Texas merged to bring 20 to 50 mm of precipitation over much of the Ottawa River Basin, at a time when spring snow melt runoff had already caused water levels to exceed major flood levels in most flood-prone areas along the Ottawa River. These weather events were the first of several that would hit the watershed and increase flood levels.

Explanation: Unfortunately, it is not possible to forecast precisely the quantity of precipitation that storm systems will bring more than a few days before they occur. Three days before the two major rainfall events arrived, on April 16, 2019, the Regulating Committee published a News Release to caution residents that based on the forecast rainfall and temperatures, levels and flows along the Ottawa River between Lac Coulonge and the Montréal Region could reach conditions observed during the first peak of the 2017 flood. However, two days later and one day before the rain began, weather forecasts were calling for much more

rain. This is why on April 18t, the Regulating Committee issued a further News Release informing residents of an increased risk of flooding, with river conditions possibly as severe as in May 2017 to be expected.

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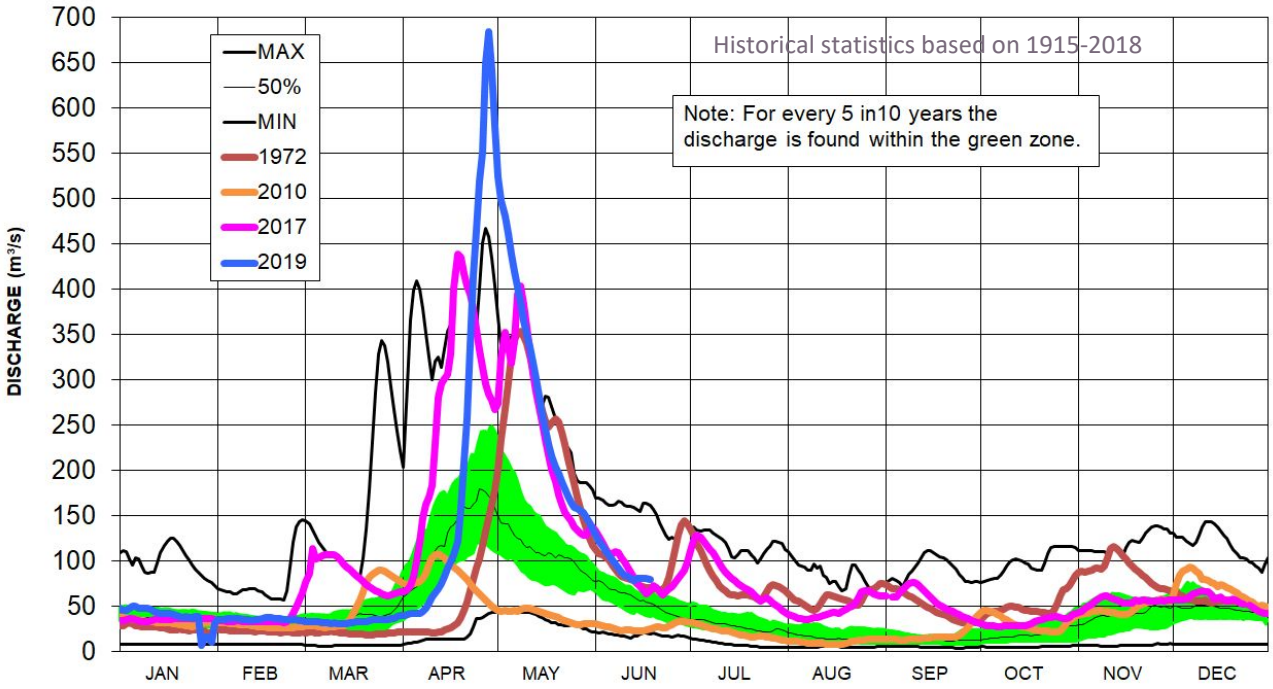
13 - Question: **Were weather conditions really that bad this year?**

Answer: Yes. The Ottawa River Basin was hit by heavy rainfall when the melting of a deep snowpack was already causing historic floods on the tributaries that feed into the Ottawa River.

Explanation: The water contained in the snowpack was approximately twice that of a normal year in early spring. The spring was late in coming with below average temperatures with snow still accumulating over much of the watershed. With little sunshine and cooler than normal temperatures, there was little reduction in the snow pack during the early spring period. April was very wet with approximately twice as much rain as normal with a sequence of heavy rainfall events through April and in to May, which added additional runoff to streams that were already swollen by significant snow melt volume.

Many tributaries (Petawawa, Coulonge, Madawaska, Petite Nation and Rouge rivers)located in the central portion of the watershed had record breaking flow rates which fed exceptional quantities of spring runoff into the Ottawa River, causing the first peak to occur between April 29th and May 1st. Other tributaries such as the Mississippi and Bonnechere rivers experienced significant flooding impacting communities along the length of their shores. Many smaller tributaries experienced unprecedented high flows that washed away portions of roads and culverts.



Variation in daily flows of the Petawawa River

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14 - Question: **Why is there flooding in some years and none in others even though the weather in these years look alike?**

Answer: Meteorological conditions vary from day to day and from year to year. Spring floods are affected by multiple factors, and no two are alike. Some years may appear to have similar meteorological conditions; however, different weather patterns, over different sectors of the basin can make a big difference in the degree of flooding experienced in some locations.

Explanation: Two years that have apparently similar weather characteristics may have very different spring floods. For example in the Lac Coulonge area, flooding occurred in 1985 and did not occur in 1984. Yet, both years had similar total precipitation. Where exactly precipitation occurs and if it is concentrated over a short or longer period of time can affect a particular location in different ways. In the case of flooding in the Lac Coulonge area, one such analysis would reveal that the peak flow rate of the Coulonge River in 1985 was about twice as large as that in 1984. Flooding on natural, unregulated tributaries, is an indication that the received precipitation was of sufficient intensity to cause downstream flooding.

Another example is the depth of the snowpack, which is used as an indicator of the amount of water available to melt in spring. Generally, the water contained in the snowpack is only an indicator of the

possible river conditions during the spring given that a large portion of the snow could be lost to the atmosphere.

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15 - Question: **Why is my town experiencing worse flooding than others?**

Answer: Weather conditions, the natural characteristics of the downstream river such as narrows and rapids, and a town's geographic locations compared to the principal reservoirs in the north govern the timing of and the degree to which different towns experience flooding. Also, the particular areas which are receiving rain can impact where flooding is the worst.

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16 - Question: **Can we expect these large-floods every few years? Is flooding the new norm?**

Answer: Flooding is not expected to happen every other year. On any given year, there is 5% chance of having a medium flooding event (for example a 1:20 yr flood) and there is a 1% change of having an exceptional flood event (for example a 1:100 yr flood). However, it is possible for large flood events to be clustered, like events that occurred in the 70s, rather than evenly distributed in time.

Explanation: Flows in the Ottawa River vary from year to year because the weather conditions over the watershed such as precipitation and temperatures change from year to year. The sequence of precipitation and temperatures that give rise to flooding is determined by nature. This is why the risk of flooding is often described as a probability of occurrence such as the 5% chance or 1% chance of flooding on any given year.

Some will remember the flooding that occurred in the 1970's. Serious flooding happened in 1974 and 1976 in many areas. Yet, flows over the next two decades were generally within the normal range and did not cause serious flooding. Natural variability is unfortunately easily forgotten and this is part of why exceptional floods are so often unexpected. Significant flooding along the Ottawa River occurred in the 1920's, the 1950's, the 1970's and in the 2010's. Flooding will occur again, we just don't know when.

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17 - Question: **Are Québec agencies and Ontario agencies talking with one another**?

Answer: Québec and Ontario agencies involved in the management of the principal reservoirs on the Ottawa River flows communicate daily throughout the spring flood season to assess together current and forecast river conditions and what actions may be required to minimize flood impacts.

Explanation: Agencies with principal reservoirs within the Ottawa River basin make up the Regulating Committee (refer to Question 5 As part of the Committee's work, operators of all principal reservoirs assess together current river conditions, forecast river conditions, operational strategies such as increasing or decreasing flows at the principal reservoirs and relevant information to governmental agencies and the public on expected river conditions.

In 2019, fifty conference calls were held during the spring freshet by the Committee.

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18 - Question: Are dams (reservoirs) managed by computers?

Answer: Analyses and decisions pertaining to water management strategy are done by qualified and experienced technical staff. However, many processes are automated, for example the collection and transmission of hydrological data and the operation of some water flow control structures, which is under constant human supervision. In addition, various technologies are used to provide guidance and decision making support, for example meteorological and hydrological forecasting models. Modelling and forecasts are ultimately only used as input to the decision making process for the operation of the principal reservoirs.

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19 - Question: **What has the Ottawa River Regulation Planning Board done to improve its communications following 2017? What else should be done?**

Answer: Following the 2017 spring flooding, the Planning Board undertook several actions that involved communications. Given the importance of timely flow forecasts in protecting against flooding, it consulted with provincial agencies that are responsible for flood-related messaging to residents. Improvements to pathways of communication were subsequently identified and implemented. The Planning Board also heard the public's desire for better access to river flow conditions and initiated a revamping of its website. In addition, the Planning Board and its member agencies, gave multiple outreach presentations to municipal officials in Ontario and Québec to raise awareness on the limits of regulation and ensure emergency management coordinators were aware of available forecast information.

Looking ahead, the Planning Board recognizes that communications have evolved tremendously in the last few years with social media. To adapt to this new context, it will assess what new ways can be used to communicate water management strategies rapidly and efficiently, especially during major hydrological events.

GLOSSARY :

- **Drainage basin (or watershed):** Area of land that channels rainfall and snowmelt into a body of water or stream.
- **Freshet:** Large increase of water discharged in a river during spring months due to snow melt and sometimes rainfall
- **Reservoir:** Area upstream of a dam where water is or can be stored for a long period of time (several weeks and sometimes months). A large reservoir can regulate (or alter) the flows in the downstream river section.
- **Runoff:** The excess water, from precipitation or spring melt, which isn't retained in the ground and flows into the surrounding streams.
- **Run-of-river dam (facility):** Type of hydroelectric facility where no or little water is stored. A dam is built to cause water to pond upstream, ensuring the river water is high enough to enter the pipes leading to turbines. A run-of-river facility has little ability to regulate (or alter) the flows in the downstream river section.
- **Tributary:** A stream or river which flows into a larger lake or river, for example the Petawawa and Gatineau rivers.
- **Watershed (or drainage basin):** Area of land that channels rainfall and snowmelt into a body of water or stream.