Experts Answer Your Top Questions about Water Levels

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The extreme high water levels over the last two years have once again sparked considerable interest, anxiety, and a demand for answers, as happened when we experienced extreme low water levels in 2012/3. To address these concerns, GBA and Georgian Bay Forever (GBF) jointly hosted an online water levels symposium in October 2020 to get comprehensive answers to key questions from an experienced, knowledgeable, and credible group of scientists and decision makers.

This event was highly successful, with substantive participation from both attendees and the well-regarded presenters. The presenters are acknowledged academics and institutional experts, with peer-reviewed publications in the disciplines involved. Many are responsible for the development and implementation of the regulatory Great Lakes water levels plans for Canada and the US.

Although climate change is expected to have a significant influence on future water levels, the experts, GBA, and GBF identified a range of actions that could be taken to mitigate extreme high and low water levels, and to build greater understanding of drivers of water levels in the Great Lakes.

Our Top 10 Questions on Water Levels

The 699 registrants, 432 of whom were able to join the online symposium, furnished 259 questions. Here are the top 10 questions that members wanted answers to:

1 What are the three most important things to know as an "islander" about water levels?

1) Increases in precipitation levels over the last few years have been the prime driver of the current higher levels. However, there is considerable uncertainty surrounding future water levels as no predictions are accurate beyond about six months.
2) Future extreme highs and lows may exceed past extreme levels and occur more often, so past trends may no longer be a guide to future water levels.
3) Given these uncertainties, and the potential for higher energy storms, it would be prudent to plan for wilder weather, lower lows, and higher highs going forward.

2 Can something be done to stop the rising water on Georgian Bay? How can the levels be controlled? Is there any ability to control lake levels?

Governments do not control water levels. The levels are dictated primarily by changing weather patterns over the years – precipitation and evaporation levels being the most significant contributing factors. However, adjustments at control structures such as dams should be used as much as possible to mitigate extreme high/low water levels.

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Photo: Rolfe Jones

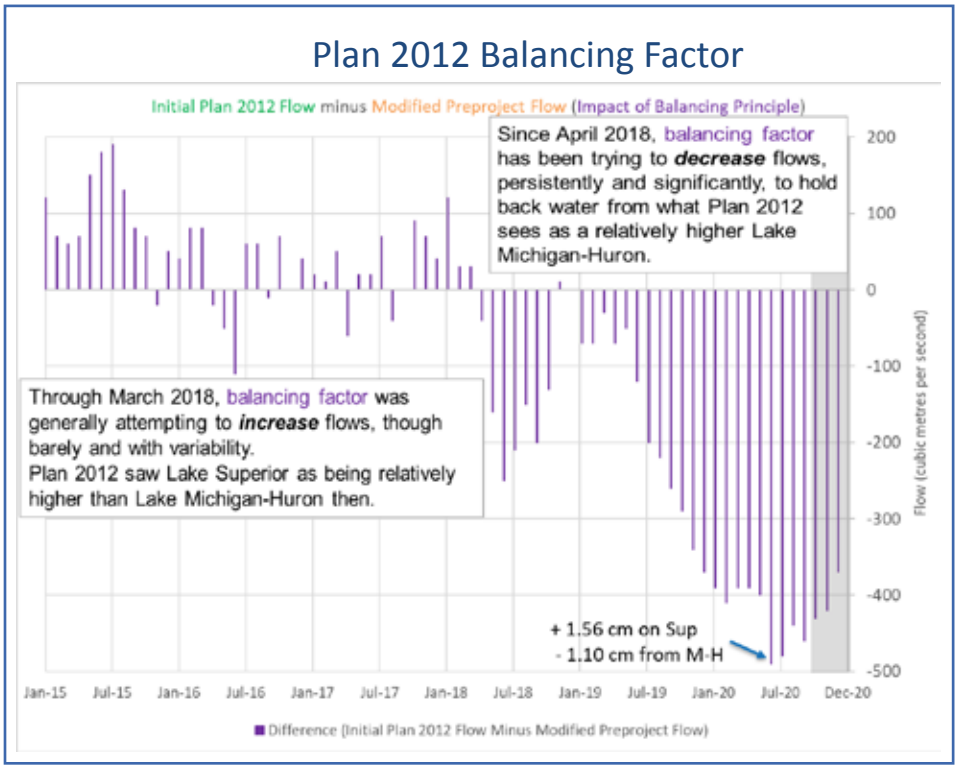
Here are details of the existing control structures:

Flow Control Structures in the Great Lakes–St. Lawrence River Basin from Upstream to Downstream			
Name	**Description/Effect and Average Flow Rate in m^3/s**		**Oversight**
Long Lac and Ogoki Diversions	Diverts much of the natural flow from James Bay to Lake Superior for 4 hydropower dams, 1 pulp and paper mill	155	Ontario Power Generation (OPG), agreement with 6 First Nations bands
St. Marys River Control Works	Connecting channel between Lake Superior and Michigan–Huron. 3 hydropower dams, Soo Locks, Compensating Works, fishery dike	2,140	International Lake Superior Board of Control
Chicago Diversion	Diverts water from Lake Michigan into Mississippi River basin at Chicago	91	US Army Corps of Engineers (USACE)
St. Clair River	Dredging of shipping channels, shore hardening, shifts in sand bars, changes in conveyance	5,210	No controls
Welland Canal	Bypasses Niagara Falls for commercial shipping	227	St. Lawrence Seaway Management Corp.
Niagara River	Minor works for hydropower diversions, no impact on lake levels	6,030	OPG and New York Power Authority, International Niagara Board of Control
Moses–Saunders Power Dam and Long Sault Dam	From Lake Ontario through St. Lawrence River. Hydropower dam, spillway, seaway	7,370	International Lake Ontario–St. Lawrence River Board

Source: Rob Caldwell, Canadian Secretary, International Lake Superior Board of Control.

3 It appears this year that the outflow from Lake Superior has exceeded agreed-upon limits. Why is Plan 2012 not being followed?

The graph on the right clearly shows that Plan 2012 has been correctly applied, and the outflow from Lake Superior has not exceeded agreed-upon limits. The aim of Plan 2012 – to balance the interests of Lakes Superior and Michigan-Huron (M-H) in setting outflows from Lake Superior – is being implemented.



4 What can be done to better regulate Lake Michigan-Huron water levels?

We learned about the coordination among the three control boards – St. Marys River Control Works; Niagara River; and Moses-Saunders Power Dam and Long Sault Dam – but it is clear that these three boards do not coordinate to any great extent with the other control structures on the Great Lakes (see above chart for a list of all the control structures).

GBA and GBF believe that some improved mitigation of extreme high/low water levels could be achieved by improved coordination of flow rates/adjustments among the control structures in the upper Great Lakes. Follow-up is needed to further explore how this might be done.

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5 Would it not be much more cost efficient to create a single organization to more effectively coordinate [data] research and management?

In some respects, the International Joint Commission (IJC) and the Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data fulfill this function, but it is certainly the case that avoiding any duplication of effort could reduce costs and/or allow for additional work to be done within the same budgets.

6 It appears that there is a need for a board that would make serious considerations about issues affecting Georgian Bay/Michigan-Huron water levels and related issues. There is a separate focus on Lake Superior and there is one for Ontario-St. Lawrence: we need a GB/Michigan-Huron Board.

Plan 2012 is currently under review and GBA plans to ensure that M-H interests are properly addressed within the new plan. We will also request that the plan includes coordination with the Long Lac/Ogoki and Chicago diversions, plus regular review of the flow rate down the St. Clair River. A board that only dealt with Lake M-H would have no power to make adjustments and is therefore unlikely to be a productive step forward to protect M-H interests.

7 If real action was called for, where are the funds/budget for it?

Both federal governments in Canada and the US have annual budgets to address Great Lakes issues, including water levels. If major investments are agreed upon, such as a control structure at the mouth of the St. Clair River (and maybe the Niagara River), this would be a long-term process which would require specific increases in funding over many years.

8 Could structures be built in the St. Clair River to lower the extreme fluctuations on Michigan and Huron? Is there hope of having them built?

There have been various suggestions on such structures over the years, including from the IJC. However, the decision to build rests with the Canadian and US federal governments and any agreement to do so is likely to be a long-term process requiring a strong consensus amongst all stakeholders to encourage action.

9 Could new water diversions be developed either before water reaches the Great Lakes or to take water from the Great Lakes?

The Great Lakes Compact, an interstate compact amongst the states adjacent to the Great Lakes, precludes any diversions that would remove water from the Great Lakes basin. However, GBA will continue to explore the potential for diversions within the Lakes to mitigate extreme water levels.

10 Will more frequent bathymetric surveys of the St. Clair River be done (at least annually)?

Previous analysis of the bathymetric data sets shows that the channel bottom has not been changing very rapidly, so the five to seven-year frequency of data collection has been sufficient. If future analyses show more rapid changes of the river bottom, the US Army Corp of Engineers (USACE) may increase the frequency of its data collection. However, collection of bathymetric data covering the entire river is very expensive, and agency budgets play a role in setting the frequency of surveys.

Our Top 10 Key Takeaways on Water Levels

Some of our key takeaways from the symposium are covered in the top 10 questions above. Here are our other top 10 takeaways:

1. There is no evidence that the current management of the Great Lakes system is deficient in any meaningful way, including regulation under Plan 2012. Given the limited tools available to manage water levels and the minor impact of adjustments at control structures, we should not expect the solution to extreme water levels to lie with improved management of the current system.

2. However, it would be worthwhile to revisit the formation of a Great Lakes Levels advisory body, previously proposed by the bi-national Great Lakes Adaptive Management (GLAM) Committee.

3. Although the IJC plays an important role generally in terms of research, coordination, and cooperation, it can only make recommendations to the US and Canada federal governments to take action. The IJC has no power itself to implement any action.

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4. The release of a key research study by Environment and Climate Change Canada (ECCC) has been delayed by over a year now. Since this study incorporates research by a range of knowledgeable and credible experts, it is expected to provide the most important guideline for what we can expect for water levels over the next 80 years or so. Delaying its release has probably already denied access to vital data for those making investment decisions to address water level issues, from marinas, to municipalities, to ports, and to you at your seasonal residences.

5. A number of specific improvements to the quality and content of water levels data and modelling that could and should be made were identified. This would help to provide the best possible information to inform decision-making, as well as furnish understandable information for the general public.

6. Why is the historic range of water level fluctuations on Lake Michigan-Huron so much higher than the range on Lake Superior? The main determinants of this are topographical and hydrological differences between the two lakes that create more variability in precipitation and evaporation for Lake M-H due to three factors:

   1) The ratio of Lake M-H's drainage basin to surface water area is much larger than Lake Superior's
   2) The surface water area of Lake M-H is 43% larger than Superior's
   3) Lake Superior has no upstream water basin

   This means that, for instance, when a storm passes through the Great Lakes area, there is a higher likelihood that the precipitation will fall on M-H's larger drainage basin and surface area, meaning proportionally more water could be absorbed into the system. In addition, any of the precipitation that falls on Lake Superior will also eventually make its way down into Lake M-H.

   Accordingly, Lake M-H's water level fluctuations are primarily due to these structural differences. They are not materially affected by the actions of the International Lake Superior Board of Control or the IJC, or by Plan 2012. A fuller explanation of this can be found on page 17 of the synopsis of the water levels symposium at: **georgianbay.ca/water/water-levels/water-levels-symposium-2020/**

7. After the symposium, GBA and GBF met with Ontario Power Generation (OPG) and determined that any adjustments at Long Lac/Ogoki are subject to two comprehensive water management plans that were put in place in 2002 to manage the Long Lac/Ogoki watershed. Since Lake Superior water levels are not considered in these plans, it has not been possible to make any adjustments at this control structure over the last 18 years, even with a minister's order, as an order cannot be used to unilaterally amend the water management plans. Further, since it is probable that only minor adjustments could be negotiated, it might not be worthwhile to pursue such changes given the minimal impact they would have.

8. However, it may be possible to make adjustments at the Chicago diversion provided the impacts are manageable and acceptable.

9. Calculating the total amount of water that enters and leaves the Great Lakes system, called the net basin supply (NBS), is important for predicting water levels. The two different methods of calculating net basin supply (NBS) are not in conflict, but simply calculate NBS in two different ways for different purposes. The **components method** calculates the NBS as precipitation over the lake, plus runoff from the basin, minus evaporation. The **residuals method** calculates NBS as the water volume caused by the month-over-month lake level change, less the flows in, plus the flows out. Residual NBS works well in the development of regulation plans but is incapable of being used for the simulation of climate impacts on water levels, which use the components method. In the symposium the Large Lake Statistical Water Balance Model (LLSWBM) was discussed. LLSWBM reconciles discrepancies between the model and measurement-based estimates for these two different methods.

10. The tools we currently have to mitigate extreme high and low water levels are very limited. Adaptive management techniques/practice can only provide a partial offset to extreme water level impacts. Since more extreme levels are predicted to occur more often, we should examine implementing additional tools and solutions. It is likely that such tools will require major investments, but the cost of such investments will almost certainly be much lower than the total costs to governments, businesses, and residents of doing nothing and suffering the full impacts of extreme high and low levels in the future.

GBA will be taking action on all the above items. The synopsis of the event, which contains more details of specific action items and the full list of questions and answers can be found at: **georgianbay.ca/water/water-levels/water-levels-symposium-2020/**