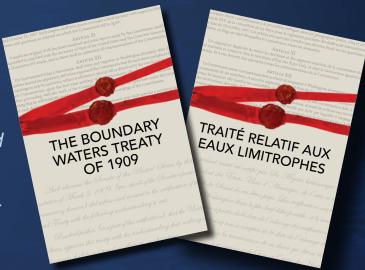


The Great Lakes in Depth

Spring 2022

WELCOME!

Welcome to the first edition of the Tri-Board Tribune, a quarterly newsletter designed by the Great Lakes Water Levels Boards of the International Joint Commission (IJC) to share information and articles related to the entire Great Lakes — St. Lawrence River basin and provide regional updates presented by each Board. Who are the Boards? The Great Lakes Water Levels Boards include the International Lake Superior Board of Control, International Niagara Board of Control, and International Lake Ontario-St. Lawrence River Board.



Visit the Tri-Board Tribune <u>subscription page</u> to sign up for email notifications. You can unsubscribe at any time.



Read the entire treaty.

Great Lakes Basin



The Great Lakes in Depth



The International Lake Superior Board of Control is responsible for managing the control works on the St. Marys River in accordance with IJC Orders of Approval which are conditions placed on the operation of projects that would affect the natural level of boundary waters. This Board's activities influence the water levels of the upper lakes: Superior, Michigan, and Huron.

The International Niagara Board of Control oversees the operation of the International Niagara Control Dam above Niagara Falls and oversees the annual installation and removal of the ice boom at the outlet of Lake Erie. The Board collaborates with the International Niagara Committee (INC) to determine the water available in the Niagara River and Welland Canal in accordance with the 1950 Niagara Treaty.

The International Lake Ontario-St. Lawrence River Board is responsible for regulating outflow from Lake Ontario into the St. Lawrence River in accordance with IJC <u>Orders of Approval</u> which are conditions placed on the operation of projects that would affect the natural level of boundary waters. The outflow regulation influences levels of Lake Ontario and the St. Lawrence River.

Articles and information contained in this quarterly newsletter will look at the Great Lakes – St. Lawrence River system as a whole and recognize the interconnectedness of the five lakes and connecting rivers.

Did you know?

- The Great Lakes are the heart of North America that includes 22,530 kilometers (14,000 miles) of shoreline along 8 states, 2 provinces, and approximately 120 Indigenous communities.
- The length of the Great Lakes and St. Lawrence River coastline is greater than both the east and west coast of the United States.
- There are 30,000 islands in Lake Huron and over 1,800 islands in the St. Lawrence River!
- The Great Lakes form the largest group of freshwater lakes on Earth and hold 20 percent of the Earth's surface freshwater!
- The Great Lakes are so massive they create their own climates and microclimates.

The three Great Lakes Water Levels Boards want to share information with you that captures the entire system and we look forward to publishing this newsletter each quarter.

International Lake Superior Board of Control

International
Lake Superior
Board of Control



Conseil international de contrôle du lac Supérieur

This Board was established by the IJC in the 1914 Order of Approval granting permission for increased hydropower development in the St. Marys River. The Board's duties were updated in the 2012 Supplementary Order of Approval and include regulating outflows from Lake Superior into Lake Michigan-Huron and overseeing the operation of the various control works. Activities related to these responsibilities include conducting studies to develop and improve the outflow regulation plan, monitor repairs and maintenance of the control facilities, and direct flow measurements in the St. Marys River to determine the discharge capacities of the various control works.

The Board provides the IJC with advice on matters related to hydrologic conditions on the lakes, modification of the control facilities, and levels and flows in the St. Marys River, including the environmentally sensitive St. Marys Rapids. The Board meets at least twice annually, provides semi-annual progress reports to the IJC, and hosts an annual public meeting to provide information and receive input from all interested persons.



International Niagara Board of Control

International
Niagara
Board of Control



Conseil de contrôle international du Niagara

This Board was established by the IJC in 1953 to provide advice on matters related to the IJC's responsibilities for water levels and flows in the Niagara River in accordance with the mandate. The Board's main duties are to oversee water levels regulation in the Chippawa-Grass Island Pool and the annual installation and removal of the Lake Erie-Niagara River Ice Boom. The Board also collaborates with the INC, a body created by an exchange of notes in 1955 by the Governments of Canada and the United States. The INC consists of the two representatives identified in

Article 7 of the 1950 Niagara Treaty to determine the amount of water available for the Welland Canal, Niagara Falls, and subsequent power generation. The INC reports directly to the Governments of Canada and the United States and does not report to the IJC.

The Board meets at least twice a year and provides semi-annual progress reports to the IJC. The Board also produces an annual report on the operation of the Lake Erie-Niagara River Ice Boom and hosts an annual public meeting to provide information and receive input from all interested parties.

International Lake Ontario-St. Lawrence Board

International Lake Ontario -St. Lawrence River Board



Conseil international du lac Ontario et du fleuve Saint-Laurent

This Board was originally developed by the IJC in the 1952 Order of Approval as part of the approval for construction of the Seaway, but has existed under this current name since the 2016 Order of Approval. The Board's main duty is to ensure that outflows from Lake Ontario into the St. Lawrence River meet the requirements of the IJC's Order and regulation plan.

The Board meets at least four times a year, more often by teleconference when required, and provides semi-annual reports to the IJC. Staff from the Board's support offices in Canada and the United States monitor

water levels and flows daily, coordinate with dam operators, and keep the Board informed of water level conditions. The Board hosts an annual public meeting to provide information and receive input from all interested persons.

The Great Lakes in Depth



Boundary Waters Treaty of 1909



The Boundary Waters Treaty of 1909 is an agreement between Canada and United States that relates to the binational management of waterways located between the two countries. The boundary extends 8,891 kilometers (5,525 mi), beginning in the west where

the Pacific Ocean meets the Puget Sound-Strait of Juan de Fuca Watershed and continuing east to the Atlantic Ocean. It includes the following watersheds: Columbia River, St. Mary and Milk Rivers, Poplar River, Souris River, Red River, Lake of the Woods and Rainy River, Great Lakes - St. Lawrence River, Lake Champlain, Lake Memphremagog, St. John River, and St. Croix River. The boundary between the state of Alaska

and Canada extends 2,475 kilometers (1,538 mi) and crosses several Alaska-Yukon-British Columbia watersheds. Click on the following link and scroll midway to learn about each transboundary watershed: https://

The Treaty has provided a foundation for cooperation of shared natural resources based on equality between the two countries and established the IJC to investigate, resolve, and prevent boundary water disputes between the two countries. The Treaty generally does not limit the activities of either country so long as water levels, flow, and quality are not affected in the other country.

The Treaty requires the IJC to have jurisdiction over all cases, projects, etc. that include the use or obstruction or diversion of the waters, that are referred to it by the two governments.

There are limitations in what the Boards can and cannot do in accordance with the Treaty. The regulation plans influence flows based on current water level conditions and natural water supply that are governed by precipitation, evaporation, and runoff. The regulation plans and the Treaty were not written, and do not have the capability, to control or eliminate flood or drought conditions.

Great Lakes Coastal Resiliency

In 1993, the IJC completed the Levels Reference Study to determine the feasibility of building more dams and dredging the outlet channels¹ to further regulate the levels and flows of the Great Lakes and St. Lawrence River. It was determined the cost of such efforts, which would be the responsibility of federal, provincial, state, and local governments, would



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be cost prohibitive and have significant negative environmental impacts. Instead, the study recommendations pointed to proactive measures including comprehensive and coordinated land-use and shoreline management programs implemented throughout the basin to reduce vulnerability to flood and erosion

damages. The study recommended state, provincial, and local government leadership to alleviate or minimize property damages under high water level scenarios through implementation of emergency preparedness plans, comprehensive shoreline management programs, and monitoring shoreline erosion, bluff recession, and land use.

More recently, in the United States, a collaborative effort by the eight Great Lakes states, U.S. Army Corps of Engineers, National Oceanic and Atmospheric Administration, US Geological Survey, Federal Emergency Management Agency, and US Environmental Protection Agency has been initiated to improve the resiliency of the Great Lakes coastline through the Great Lakes Coastal Resiliency Study (GLCRS). To protect the immense economic, environmental, and social value of the Great Lakes shoreline, this study would identify areas vulnerable to conditions that contribute to hydrologic uncertainty. The study would recommend measures to bolster the coastline's ability to withstand, recover from, and adapt to future lake level conditions and increased storm severity. Without such a study, federal, state, and local agencies would continue to address coastal vulnerabilities through a piecemeal approach and would lack the necessary information to support effective and efficient management decisions.

Additional resources to address coastal resilience throughout the Great Lakes include, but is not limited to, the Ontario Climate Consortium, hosted by Environment and Climate Change Canada, the Canadian Coastal Resilience Forum hosted by the University of Waterloo, Ocean Program – coastal resilience technology theme, U.S. Climate Resilience Toolkit, Resilient Great Lakes Coast a resource specific to the State of Michigan, and Lake Ontario Resiliency and Economic Development Initiative specific to the State of New York.

Adaptive Management of Regulation Plans

A regulation plan is a set of rules used to determine the release of water from a lake. The rules are designed to adhere to specific physical and operational limits. It is important to note that no outflow management strategy can fully control lake levels. This is because the major factors affecting water supply to the Great Lakes: precipitation, evaporation,

and runoff, cannot be controlled, and are difficult to accurately predict.

Climate change poses new challenges for adapting to fluctuating Great Lakes and St. Lawrence River water levels. Increases in temperature and alterations in patterns of precipitation have already begun to affect water supplies and levels in the Great Lakes including recent extreme



de contrôle du lac Supérieur

Lake Ontario -St. Lawrence River Board



du lac Ontario et du fleuve Saint-Laurent

high and low water levels that were outside the historical range experienced over the past century. Adaptive management of outflow regulation plans allow for an on-going review and evaluation of a broad range of environmental and economic indicators that evolve over time. The adaptive management process allows for review and evaluation of changes in the system, including hydrology and climate change, to refine and improve outflow management.

Plan 2012 is used to determine outflows of Lake Superior into Lake Michigan-Huron. Information about the Plan 2012 adaptive management review is expected later this year. Plan 2014 is used to determine outflows of Lake Ontario into the St. Lawrence River. Details of the Plan 2014 adaptive management review are available at

https://glam-engage.ijc.org/.

¹St. Marys, St. Clair, Detroit, Niagara, and St. Lawrence rivers

The Great Lakes in Depth



What Great Lakes Community Represents You?



Each of the five Great Lakes and St. Lawrence
River are unique, as are the communities and
interest groups within the basin. Take a moment
to learn about the different communities and

interest groups, and facts about each demographic, that live, work, and recreate within the Great Lakes – St. Lawrence River basin. Which community represents you?



Agriculture: This includes farmers, farm bureaus, and other entities that represent the agricultural community.

The fertile land surrounding the Great Lakes is home to approximately 7 and 25 percent of American and Canadian agriculture, respectively. The fertile land and natural water source provide ideal conditions to grow corn, soybean, hay, and produce dairy products. Crops and livestock within the Great Lakes region generate \$14.5 billion in annual agricultural sales.

Data source: The Nature Conservancy.



Commercial Shipping and Ports: This includes those using the five lakes and connecting tributaries to move goods and people for commercial purposes including various Port Authorities.

- The Great Lakes St. Lawrence Seaway navigation system extends 3,700 km (2,300 miles) from Duluth, Minnesota to the Atlantic Ocean.
- One shipload of iron ore can produce enough steel to manufacture 87,000 cars.
- The binational navigation system of the Great Lakes-St. Lawrence River moves 160 million metric tons of essential raw materials and finished products annually.
- Great Lakes shipping supports 237,868 jobs in Canada and the United States annually.
- Commercial navigation contributes more than \$30 billion to the Canadian and United States economies.

Data source: Great Lakes Seaway Partnership.

Conservation and Governmental Organizations, Municipalities, and Academia: This includes local

governments, elected officials, governmental organizations focused on conservation as well as environmentally focused non-profits, and academia.

The Great Lakes – St. Lawrence River region is a world leader in natural resource contributions, research and development, manufacturing, machinery, and most notably the automobile industry. Opportunities for undergraduate and graduate studies are abundant throughout the region.

Data source: New World Encyclopedia.

Hydropower and Industrial Users: This includes those interests that generate electricity.

The hydropower dams within the Great Lakes – St. Lawrence River, specifically the hydropower plants in the St. Marys River at Sault Ste. Marie, Niagara River near Niagara Falls, and the Moses-Saunders Power Dam, and Beauharnois Power Dam in the St. Lawrence River harness the natural water flow and water supply to generate hydropower. These dams did not result in the construction of reservoirs, but they do influence the levels of lakes Superior and Ontario.

In fact, regulation plans managed by the Boards were developed to guide outflow through the hydropower systems to support the generation of electricity while ensuring and maintaining the flows within the Great Lakes – St. Lawrence River system. The regulation plans are not designed nor able to keep any lake at a specific level. The ability to regulate flows through the St. Marys River and the St. Lawrence River is often misunderstood; outflow management does not mean and was never intended to insinuate that full control of lake levels in any of the Great Lakes is possible. This is because the major factors affecting water supply to the Great Lakes, precipitation, evaporation, and runoff cannot be controlled, are much more variable than the outflow and are difficult to accurately predict.

Indigenous People: This includes First Nations, Tribal Nations, and Métis Nations. Incorporating traditional knowledge (appreciation and respect for the earth, air, and water that are essential to life) with western science ensures that a well-rounded set of perspectives exists in the work we undertake.

The Great Lakes and St. Lawrence River are home to approximately 120

Indigenous communities. Consultation and collaboration with Indigenous communities is intended to honor and uphold trust and treaty responsibilities in Canada and the United States in a way that supports tribal cultures, traditions, and recognizes the interconnectedness with the Great Lakes – St. Lawrence River ecosystem.

Recreation and Tourism Groups, Riparian Businesses: This includes people and organizations focused on activities such as boating, hunting, fishing, and wildlife watching as well as those near shoreline business owners or commercial property owners.



- Recreation and tourism on the Great Lakes-St. Lawrence River generates more than \$52 billion annually.
- The Great Lakes-St. Lawrence River represent 15 percent of North America's tourism.
- Approximately 84 percent are domestic tourists.
- Day trip tourists represents 75 percent of the tourism activity.
- Tourism employment in the Great Lakes supports 29 percent of North America's jobs

Data source: Great Lakes Commission and Council of the Great Lakes.



groups of people.

Riparian Residential: Riparian areas are the location where land and water meet along stream and riverbanks, shoreline coasts, and include floodplains. Residential riparian represents shoreline or near shoreline property owners and renters, as well as those organizations representing these

Approximately 34 million people live within the Great Lakes basin along with more than 3,500 species of plants and animals, including 170+ species of fish. It is unknown how many property owners live within the riparian zone of the basin, but it is important for all residential riparian property owners to maintain coastal resilience awareness to remain informed and prepared for weather and climate-related events including rising waters to have the ability to rebound more quickly and reduce human health, environmental, and economic impacts.

Data Source: <u>Michigan Sea Grant</u> and <u>National Oceanic and</u> <u>Atmospheric Administration</u>.

The Great Lakes in Depth



Great Lakes-St. Lawrence River Water Levels – Current Conditions and Six-Month Forecast



Water levels throughout the Great Lakes system typically reach their seasonal low points between December and March. Peak water levels this spring and summer will depend on weather and water supplies over the coming weeks.

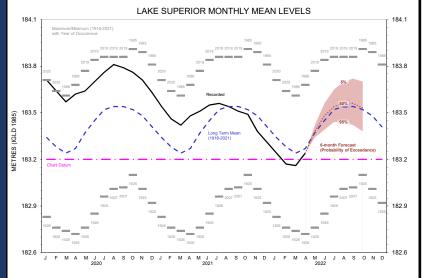
 Lake Ontario is forecast to begin its seasonal decline in May or June. Under average weather and water supply scenarios, water levels are forecast to remain above average through May and June and transition near to below long-term average July through September.

• Water levels at Montreal Harbor are expected to begin a seasonal decline through the summer. Water levels are forecast to remain above long-term average for this time of year.

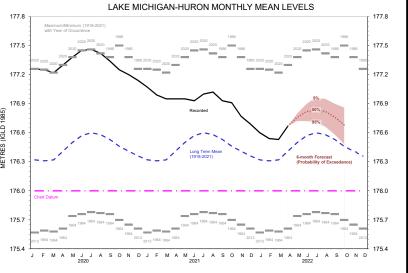
It is important to note that the International Lake Ontario-St. Lawrence River Board coordinates with the <u>Ottawa River Regulation Planning Board</u> in the spring to assess snowpack and the expected Ottawa River freshet. The freshet outflow affects the regulation of Lake Ontario outflows and thereby its water levels, as well as levels on the St. Lawrence River downstream as far as Three Rivers (Trois Rivieres).

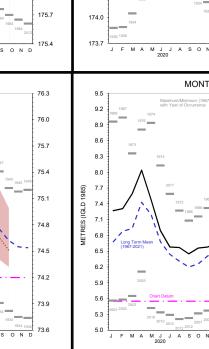
The current six-month forecast predicts the following for the Great Lakes:

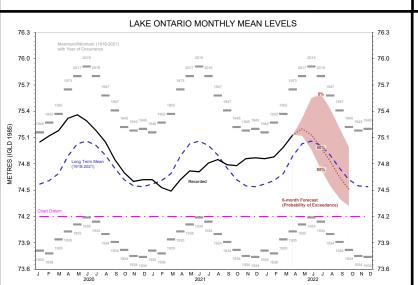
- Lake Superior is expected to continue its seasonal rise into late summer or early fall before beginning its seasonal decline. Under most potential weather and water supply scenarios, water levels are expected to be slightly above long-term average.
- Lake Michigan-Huron is forecast to continue its seasonal rise into July. Water levels are expected to remain below record highs, but above average.
- Lake Erie is expected to continue its seasonal rise into June and begin its seasonal decline later this summer.
 Water levels are expected to remain below record highs, but above average.

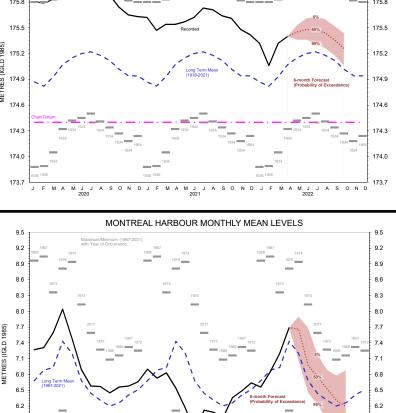


LAKE ERIE MONTHLY MEAN LEVELS









LAKE ST. CLAIR MONTHLY MEAN LEVELS

173.9

The Great Lakes in Depth



Climate Change in the Great Lakes



Many discussions about climate change focus on sea level rise and impacts to ocean coasts. However, the processes that result in sea level rise (ie. thermal expansion and glacial melt) are not the same in the Great Lakes and thus it is not as easy to just say that the levels of the Great Lakes will be increasing. Overall,

the levels of the Great Lakes are a result of the water supplies (ie. precipitation, runoff, and evaporation) the basin experiences. The long term rise and fall of the lake levels depends on the balance between these factors and thus in a changing climate the lake levels will be a result of their relative changes.

Changes in climate impact the water supply in complex and sometimes contradicting ways, making direct attribution of water level changes related to and caused by climate change more challenging.

Bloomberg reported in September 2021, that Great Lakes scientists have evidence that climate change is causing shifts in the historic high and low water levels. More specifically, periods of high-water levels are expected to be higher than historically recorded and periods of low water levels are expected to be lower than historically recorded. Research has led the science community to predict that these cycles could occur more often.

Over <u>100 years</u> of water levels data shows periods of high and low water levels that have lasted anywhere from 10-20 years before shifting. Climate change has altered these shifts in duration and intensity, and as we continue to learn about the impacts of climate change, we will continue to learn about how these changes will impact water levels throughout the basin.

Overall, the Great Lakes – St. Lawrence River region has experienced warmer spring and summer temperatures that have caused average surface water temperatures to slightly increase since 1995. Warmer temperatures have caused shorter ice seasons (ie. the amount of time that the lakes are ice covered) throughout the Great Lakes. In addition to temperature, another important factor of climate change is humidity. In early January 2022, the Proceedings of the National Academy of Sciences published a study that explains that increased humidity causes weather extremes including floods, storms, and droughts because water vapor traps gas in the atmosphere. Water vapor is a key element that drives precipitation events and increases climate change. The study showed that from 1980 to 2019, the worldwide temperature increased about 0.79 degrees Celsius (1.42 degrees Fahrenheit). However, once the effect of humidity is considered, the world has warmed and moistened 1.48 degrees Celsius (2.66 degrees Fahrenheit) in the recent 40 years.

This winter the maximum ice cover on the Great Lakes was measured at 56 percent on February 26. Due to warmer temperatures the last week of February and first week of March, the ice cover on the Great Lakes decreased to 42 percent by March 6. In addition, Lake Superior experienced the 7th wettest net basin supply for the month of December followed by the lowest net basin supply on record in January. Lake Michigan and Lake Huron recorded the 8th driest January and Lake Erie recorded the 9th driest January on record for net basin supply. However, Lake Ontario experienced consistently higher than average net basin supply conditions.

The Library and Information Science Network has an informative frequently asked questions page titled 'If sea levels rise what happens to the Great Lakes' that may be of interest to our readers.

Join Us at Soo Locks Engineer Day, June 24-25, 2022

Soo Locks Engineer Day is hosted by the City of Sault Ste. Marie, Sault Area Convention and Visitors Bureau, and the United States Army Corps of

International Lake Superior Board of Contro



Conseil international de contrôle du lac Supérieur

Engineers. Soo Locks Engineer Day celebrates the engineers who built the Soo Locks as well as the men and women of the past and present who maintain the locks. Visitors are encouraged to explore the Soo Locks and enjoy the rare opportunity to walk across the lock walls!

Many vendors, interest groups, and not-for-profits participate in Engineer's Day. The International Lake Superior Board of Control will host an exhibit that will feature information about the International Joint Commission and Great Lakes water levels. We hope to see you June 24 and 25!

For additional information visit https://www.saultstemarie.com/events-calendar/soo-locks-engineers-weekend/

Lake Erie-Niagara River Ice Boom Removed April 4, 2022

International Niagara Board of Control



Conseil de contrôle international du Niagara

The Lake Erie-Niagara River ice boom was removed during a one-week period from March 29 through April 4. The ice boom is installed each year to accelerate the formation and stabilization of the natural ice arch that forms at the outlet of Lake Erie near the head of the Niagara River. An ice arch is a block of ice that prevents other pieces of ice from moving further downstream. The ice boom is installed to reduce the frequency and duration of heavy ice runs into the Niagara River. These ice runs may cause ice jams, damage shoreline property, and reduce hydropower diversions.

The ice boom is 2,700 meter (8,800 feet) long and consists of 22 spans of steel pontoons. Each span is comprised of 10 pontoons. The steel pontoons are designed to submerge during intense storms to allow ice to flow downstream to prevent upstream flooding. After the storm, the pontoons re-emerge to allow the ice arch to reform.

The ice boom is owned, operated, and maintained by two power entities: Ontario Power Generation and New York Power Authority. However, the International Joint Commission, through an Order of Approval originally issued in 1964 and last amended in 1999, approves the installation of the ice boom in accordance with the terms of the Order.

The Order of Approval for the Ice Boom requires that it is removed by April 1st. However, depending upon the ice and weather conditions, removal may be delayed if the ice cover in the eastern section of Lake Erie is greater than 650 square kilometers (about 250 square miles) or downstream conditions would be negatively impacted by removal of the boom. Representatives of the International Niagara Board and the Power Entities regularly communicate during the ice season, and based on conditions, decide when the ice boom is to be removed.

Frequently asked questions about the ice boom are available at https://ijc.org/en/nbc/watershed/faq/6.

The Great Lakes in Depth



International Lake Ontario-St. Lawrence River Board Hosted Virtual Public Meeting to Discuss Spring Forecast

International Lake Ontario -St. Lawrence River Board



Conseil international du lac Ontario et du fleuve Saint-Laurent Two virtual public meetings were hosted by the International Lake Ontario-St. Lawrence River Board April 19 and 20 in English and French, respectively. The presentation at these meetings included the most up-to-date six-month forecast and provided an opportunity for attendees to ask guestions of Board members.

Over 100 people attended the April 19 meeting in English and 6 persons attended the April 20 meeting in French. Questions focused on current water levels and forecast conditions. The Board continues to share weekly water updates on Facebook and issues press releases

to share updates and information about water levels.

Video of the virtual meeting is available at https://vimeo.com/701764850.



Tri-Board Virtual Public Meeting



The International Lake Superior Board of Control, International Niagara Board of Control, and International Lake Ontario-St. Lawrence River Board has hosted a tri-board public meeting the last two years to provide an overview of the current and forecast conditions of the Great Lakes – St. Lawrence River and discuss water

levels throughout the system. The three Boards plan to host another joint public meeting this summer. In addition to information shared by the three Boards, the Great Lakes-St. Lawrence River Adaptive Management (GLAM) Committee will present an update on the ongoing review of the Lake Ontario-St. Lawrence River Regulation Plan 2014, and the review process planned for the Lake Superior Regulation Plan 2012. All interested parties are invited to attend. Please follow us on Facebook for updates and information about date, time, and location of the tri-board public meeting.

Visit the Tri-Board Tribune <u>subscription page</u> to sign up for email notifications. You can unsubscribe at any time.





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International Lake Superior Board of Control



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