ISLRBC FAQs

The purpose of these FAQs is to provide stakeholders along Lake Ontario and the St. Lawrence River with information on how the International St. Lawrence River Board of Control manages the St. Lawrence River flows under the direction of the International Joint Commission's "Orders of Approval" while also ensuring the most equitable distribution of benefits and impacts for all citizens living and working along this magnificent and spectacular watercourse.

These FAQs represent questions that have commonly been asked or address areas where we feel additional information would be useful for the public. We would sincerely appreciate your comments and suggestions in order to provide the best information and perspective for you, the citizens of the Lake Ontario and St. Lawrence River System and stakeholders, regarding management of its waters for all interests.

Please send your comments, suggestions, and questions to the Board's secretaries: Contact Us.

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1. Influences on Water Levels and Flows

1.1 Why do levels and flows fluctuate in the Lake Ontario-St. Lawrence River system?

The greatest influence on water levels is hydrology: the natural system of water storage, groundwater and stream-flow transport, precipitation, evaporation, formation and travel of clouds, and wind. Hydrology is directed and dominated by natural forces. The sole regulatory factor is the Moses-Saunders Dam which, as you may discover below and in Section 2, is far less significant than the natural factors affecting water levels. Weather patterns, precipitation, and winds are major influences within the hydrologic system. The hydrologic system is worldwide, but the hydrologic effect on Lake Ontario is mainly the outflow of Lake Erie, the precipitation and evaporation over Lake Ontario, and the runoff from Lake Ontario's local drainage basin. The vast majority of water supply into Lake Ontario is outflow from Lake Erie. This outflow is uncontrolled and is a function of the larger hydrologic system of the Great Lakes upstream.

The Lake Ontario system contains three major cycles:

1. Persistently high or low precipitation over several years is the main natural factor causing extreme high or low Lake Ontario levels. Prior to regulation, Lake Ontario experienced extreme low levels in the mid-1930s and extreme high levels in the early 1950s, as shown in the plot of monthly lake levels shown below.

2. In spring, the melting snow and spring rains increase runoff into the lake. However, the lake is cooler than the air above at this time of year. As a result, less water evaporates during the spring than in the fall and early winter. With more water entering the lake than leaving, water levels usually rise, ultimately reaching their peak in the early summer. In general, water levels in Lake Ontario are lowest in the late fall and early winter. At this time of year, water on the surface of the lake is warmer than the air above. As a result, water evaporates rapidly. With more water leaving the lake —in the form of water vapor — than entering, water levels decline. This annual cycle may be seen in the plot of pre-project water levels.

3. Within this seasonal variation, water levels may also change in a matter of hours because of wind effects.

1.2 Water from Lake Erie, precipitation, and wind are the major natural forces affecting Lake Ontario. How significant are these forces, and why?

The three most significant natural forces affecting water levels in Lake Ontario are the inflow from Lake Erie, precipitation and evaporation, and wind.

Inflow from Lake Erie: On average, Lake Erie supplies 80% of the inflow into Lake Ontario. The majority of flow from Lake Erie to Lake Ontario is conveyed via the Niagara River. Inflows to Lake Ontario from the Niagara River, which are unregulated, are determined by Lake Erie water

levels. Although Niagara River flows are fairly constant, with an 11% variation during the year on average, the inflow into Lake Ontario is typically highest in June and lowest in February, corresponding to the levels on Lake Erie.

Local Precipitation and Evaporation: Precipitation (rain and snow) over the lake, the runoff from the precipitation over the local drainage basin, and evaporation of water from the lake surface account for, on average, the remaining 20% of the water supply. During late summer and fall, evaporation from the lake surface can exceed inputs of water due to precipitation and local runoff, causing a net negative local water supply over a given period of time.

Wind: Strong, sustained winds from one direction may push the water level up at one end of Lake Ontario, causing the level to go down by a corresponding amount at the opposite end. The effect is known as a “surge”. This is a short-term fluctuation, changing in a matter of hours. Once the sustained winds subside, the water will oscillate back and forth in the lake and bays until it levels itself out, much as it would in a bathtub. This is known as “seiche”. On Lake Ontario, wind surges have raised the local levels by as much as half a metre (1.5 feet). In general, wind effects have a maximum duration of a few days and do not usually affect the weekly regulation of flows by the Control Board.

The Board has no control over any of these three natural factors: the inflow from Lake Erie, the precipitation and evaporation, or the wind. Additionally, seasonal variation can influence the regulation of flows from Lake Ontario, as naturally occurring weather conditions are beyond human control. For more details, the interested reader may wish to peruse the documents available on our bookshelf, available on the webpage: Publications.

1.3 What influence does isostatic rebound have on what is happening to water levels and water access around the Lake Ontario shoreline?

Overall, isostatic rebound, which is the process whereby the earth’s crust is slowly adjusting to the lack of the weight of the glaciers from the last ice age, affects the north shore as well as the south shore of Lake Ontario. In general, the west end of the lake is sinking relative to the outlet, the St Lawrence River. Isostatic rebound means slightly deeper water for the northwest shore (15 cm) and for the southeast shore (4 cm) for the same given water level compared to 100 years ago.

1.4 What influence does climate change, increased evaporation and other factors have on what is happening to water levels and water access around the Lake Ontario shoreline?

Several long-term processes could affect coastal and boating risks, and unfortunately none of them seem to be for the better. These processes include isostatic rebound (a certainty); the possibility of more extreme water supply conditions (both wet and dry); the possibility of storms that are more severe (especially when there are higher atmospheric temperatures and water content); increased erosion impacts in winters when there is less ice along the shoreline; and increased erosion on unprotected parcels due to reductions in sediment transport resulting from shoreline protection on adjacent parcels. In addition to these long-term processes, short–term effects, such as wind set-up, temporarily, but at times drastically, affect water levels, particularly on the south shore of Lake Ontario.

1.5 What are the overall actual and potential impacts of these changing conditions on the north shore of Lake Ontario?

The north shore is somewhat less vulnerable to the effects of wind and waves due to prevailing weather patterns. The north shore is also somewhat less susceptible to flooding impacts because of more proactive coastal zone management practices.

1.6 How does ice affect lake evaporation and Lake Ontario water levels?

Our understanding of the complex relationships between ice cover, evaporation and water levels is evolving. Evaporation causes water levels to decline, that much we know. A commonly held belief is that high ice cover results in generally lower amounts of evaporation. This is true to some degree, in that when ice covers much of the water surface, it acts as a cap on the lake, effectively preventing evaporation from occurring. But for that high ice cover to have formed in the first place, the water needed to cool (lose energy), and the most effective way to do that is through evaporation.

Lake evaporation is at its peak in the fall and early winter, when cold, dry air passes over the lake's relatively warmer water. So during years with high ice concentrations and reduced evaporation in late-winter, evaporation rates earlier in the season may have been higher, resulting in a rapid lowering of Lake Ontario water levels.

As well, it takes a lot of energy to melt ice and snow, and ice and snow also reflect solar radiation better than dark water does. So during these same years, the water tends to stay colder than normal heading into the spring, and this will have implications later in the year, possibly delaying the onset of evaporation and the typical seasonal decline in water levels until later in the summer and fall than they would normally tend to occur.

2. Effects of Regulation on Levels and Flows

2.1 What was the purpose of the hydropower and seaway project?

The main objectives of the St. Lawrence River hydropower and seaway projects are dependable water flows for hydropower generation, sufficient water levels and flows for seaway navigation, and flood reduction both upstream and downstream of the projects. These are reflected in a series of criteria and requirements in the IJC's Orders of Approval allowing for the construction and operation of the project.

2.2 What caused changes in the levels of Lake Ontario before regulation, and what is causing changes after regulation?

The same natural factors that changed water levels in the lake before regulation continue to influence the levels after regulation. These natural factors include inflow from Lake Erie and weather patterns (precipitation, wind, and temperatures) collectively driving the hydrological system. Short-term adjustments to the outflows of Lake Ontario have little impact on the water level of that lake in comparison to these natural factors.

2.3 What was the “natural” annual cycle of levels in Lake Ontario before regulation in comparison with after regulation?

Over the years, the pattern of an early summer peak and an early winter low has been continued, on average, before and after regulation. Annual variations in the hydrologic cycle can shift the timing of these highs and lows. The average fluctuations from winter lows to summer highs is similar; prior to regulation the range was about 0.49 m (1.6 ft), since regulation began in 1960 the ranges has averaged about 0.50 m (1.6 ft). Also, since regulation began, the drop of the high summer water level to the low winter level has been slightly more rapid on average.

2.4 Why were levels on Lake Ontario lower prior to regulation than they have been since regulation?

Water levels of Lake Ontario were, on average, lower before regulation, because water supplies were, on average, less at that time. Since 1960, Lake Ontario would have set new record high water levels several times without regulation. While regulation has actually reduced the impact of higher supplies, it has not completely eliminated it. As an example, during the wet years of the mid 1980s shown in the above graph, the lake surpassed 75.3 m (247.05 feet) with regulation. The level would have reached approximately 76.0 m (249.34 feet), approximately 70 cm (over 2 feet) higher than what would have been experienced if the regulation structures and procedures were not in place.

By contrast, during the dry years of the mid 1960s, Lake Ontario would have been approximately 60 cm (2 feet) lower at times than it was with regulation as shown in the following graph. While the above examples show that the result of regulation during extreme water supply conditions can be significant, in general, during more normal water supply periods, the difference in water levels on Lake Ontario due to regulation is in the order of centimeters/inches and is typically not significant.

2.5 What has caused changes in levels of the St. Lawrence River since regulation?

The St. Lawrence River starts at the mouth of Lake Ontario and flows to the Gulf of St. Lawrence in the Atlantic Ocean. The effects of the regulation of Lake Ontario reach as far downstream as Trois Rivieres, Quebec, where tidal effects become more dominant. The International border between Canada and the U.S.A lies between the banks of the river until the Moses Saunders Dam at Cornwall, Ontario and Massena, New York. About 10 km (6 miles) downstream of that point, the river is wholly within Canada although the drainage basin also extends into the U.S.A.

Natural factors such as precipitation, runoff, and surge effects from strong winds continue to influence water levels in the St. Lawrence River and its tributaries after regulation, as they did before. The greatest tributary is the Ottawa River, which has a large influence on the levels and flows of the St. Lawrence River downstream of its junction with the river at Lake St. Louis. With regulation, the outflows from Lake Ontario may be more controlled during periods of high Ottawa River flows.

As with all large dams, the levels upstream of the dam in Lake St. Lawrence are primarily determined by the flow rate through the dam, with high flow rates resulting in lower levels and low flow rates resulting in higher levels. In addition to being affected by river flows, levels are influenced when strong winds blow the water in a surge effect anywhere along the river.

2.6 What were the “natural” levels in the St. Lawrence River downstream of Cornwall/Massena before regulation?

Prior to regulation, the St. Lawrence River downstream of Cornwall, ON and Massena, N.Y. experienced extreme level and flow fluctuations correlating with the fluctuating water level on Lake Ontario. These fluctuations were moderated to some extent by the rapids that used to be located in the river. For areas downstream of Lake St. Francis, St. Lawrence River flows were also influenced by fluctuations in the Ottawa River outflow. The most extreme fluctuations, however, were due to the frequent occurrence of ice jams in the river. The regulatory ability of the Moses-Saunders project and Hydro-Quebec operations of the Beauharnois complex have essentially eliminated the risk of flooding from ice jams. As the project may reduce outflows from Lake Ontario to counter large flows in the Ottawa River, flooding downstream of its confluence with the St. Lawrence River near Montréal has also been reduced.

2.7 What actions does the ISLRBC take to manage ice conditions in the St. Lawrence River during the winter?

Regulation of Lake Ontario outflows has greatly reduced the incidence of ice jams in the St. Lawrence River, both upstream and downstream of the Cornwall/Massena area. Prior to regulation, the frequent occurrence of ice jams in the river was a major cause of extreme fluctuations in water level and flooding of adjacent shoreline properties.

During the winter, the Board, in conjunction with their Operations Advisory Group, monitors ice formation in the St. Lawrence River closely. Outflows from Lake Ontario can be increased or decreased, as conditions require, for ice management purposes. For example, Lake Ontario outflows may be decreased below the Plan-prescribed flow to reduce the flow velocity and accommodate the formation of a stable ice cover. A stable ice cover helps prevent unconsolidated ice from accumulating at narrow points and obstructions in the river and causing ice jams and associated flooding. A stable ice cover also prevents unconsolidated ice from flowing into and clogging hydropower intakes. Alternatively, in some cases outflows can be increased to help break up and flush unconsolidated ice that has become caught or that may pose problems at certain locations. After events such as these, outflows from Lake Ontario are adjusted when opportunity arises, to return lake water levels to what they would have been if the outflows had remained as those specified by the regulation plan.

On the St. Lawrence River, the ice formation process usually begins in the lower portion of the river, just upstream of the Montreal area in the Beauharnois Canal, followed by formation upstream of Moses-Saunders Dam through the International Section of the river. When a stable ice cover has formed far enough upstream in the International Section, the Iroquois Dam gates may also be lowered to further assist ice formation from this point further upstream towards Lake Ontario. Ice booms are also used in the river to assist in ice formation.

2.8 Why is Lake St. Lawrence low when flows are high? What are the benefits and/or liabilities of such a situation?

Lake St. Lawrence, immediately upstream of the Cornwall/Massena dam, empties when flow through the dam is increased, as more water from Lake Ontario is released. The resultant lower head, the difference in water elevation through the power dam, may reduce the amount of electricity generated, if not off-set by the increase in flow. At such times, the low water levels, coupled with the higher velocity of the increased flow, make recreational boating more

dangerous. This phenomenon is present for headwater lakes located behind water control dams and should be planned for when siting docks, launches, and marinas.

2.9 How does regulation of Lake Ontario mitigate spring flooding conditions in the Montréal area?

Montréal has been prone to flooding historically, because it is located at the confluence of the Ottawa and St. Lawrence Rivers. Regulation of Lake Ontario outflows has reduced spring flooding in the Montréal area. The spring runoff from the Ottawa River basin may be very significant; it can increase tenfold in hours. Timely reductions of Lake Ontario outflows during this high-runoff period have repeatedly helped avoid serious flooding in the Montréal and Lake St. Louis areas. Higher outflows from Lake Ontario prior to, or shortly after, this period help compensate for the reduced outflow during times of high runoff. In addition as noted above, ice control in the river, which has been facilitated by the project, has significantly reduced the occurrence of flooding due to ice jams.

3. Governance and Decision-Making

Three major groups are responsible for the decision-making and governance for the Lake Ontario-St. Lawrence River system, starting with the Boundary Waters Treaty:

1. The International Joint Commission (IJC) sets the overall policy for managing water levels and flows,

2. The International St. Lawrence River Board of Control (ISLRBC) sets the strategy for meeting the IJC policies, and

3. The Canadian and U.S. hydropower entities operate the dams in the St. Lawrence River to implement the strategy of the ISLRBC.

3.1 The Boundary Waters Treaty

3.1.1 What is the Boundary Waters Treaty?

The Boundary Waters Treaty of 1909 was written to help the United States and Canada prevent and resolve disputes over the use of the waters they share.

3.1.2 What are the principal provisions of the Boundary Waters Treaty regarding projects such as dams?

In very general terms, unless there is a special agreement between the United States and Canada, new uses and obstructions or diversions of boundary waters cannot take place without the prior approval of the IJC if the proposed project will affect the natural level or flow of those waters on the other side of the boundary. The IJC considers interests in both countries in accordance with the Treaty and may require that certain conditions in project design or operation be met to protect interests on either side of the boundary. If the IJC approves a project in response to an application, it issues an ‘ Order of Approval.’ In cases where the operation of the project must meet certain conditions, such as flow requirements through a dam, the IJC appoints a board to monitor compliance with the Order of Approval on an ongoing basis.

3.1.3 Does the Boundary Waters Treaty give precedence to some uses over others?

Yes. Article VIII of the Boundary Waters Treaty states that the Commission may not approve a use that tends materially to conflict with or restrain any other use given preference over it in the order of precedence The order of precedence among the various uses enumerated in the treaty is stated as: (1) uses for domestic and sanitary purposes, (2) uses for navigation, and (3) uses for power and irrigation purposes. “Domestic and sanitary purposes” include municipal water supply and wastewater treatment. The provisions do not apply to or disturb any existing uses of the boundary waters on either side of the border.

3.2 The International Joint Commission (IJC)

3.2.1 What is the IJC?

The International Joint Commission (IJC) was established under the Boundary Waters Treaty of 1909 to help the United States and Canada prevent and resolve disputes over the use of the waters they share. Under the Treaty, the IJC approves certain projects that affect the natural levels and flows of boundary waters, such as the international navigation (the Seaway) and hydroelectric power project (the Moses-Saunders Dam) at Massena, New York and Cornwall, Ontario.

3.2.2 How does the IJC work?

The IJC has six members. Three are appointed by the President of the United States, with the advice and approval of the Senate, and three are appointed by the Governor in Council of Canada, with the advice of the Prime Minister. The Commissioners must follow the Treaty in preventing or resolving disputes. They must act impartially in reviewing problems and deciding on issues, rather than representing the views of their respective governments.

The Commission has set up more than 20 boards and task forces, made up of experts from the United States and Canada to help it carry out its responsibilities.

3.2.3 What are the Orders of Approval?

When the IJC approves a project, it issues Orders of Approval, which may require that flows through the project and corresponding levels both upstream and downstream meet certain conditions to protect interests in both countries. The Orders of Approval for Lake Ontario and the St. Lawrence River were issued in 1952 and amended in 1956. They are often referred to as the 1956 Orders of Approval.

3.2.4 What are the principal provisions of the Orders of Approval for Lake Ontario/St. Lawrence River?

The 1956 Orders approved the construction and operation of the components of the international hydropower project at Massena, New York and Cornwall, Ontario, which affect water levels and flows in Lake Ontario and the St. Lawrence River. These components include channel enlargements that increased the capacity to release water from Lake Ontario, as well as works that regulate the flows. The Orders reaffirm the priorities for water use set by the Boundary Waters Treaty (see Q 3.1.2 above), require that the works be operated to provide no

less protection to riparian and navigation interests downstream, and state that the IJC will indicate the interrelationships among the requirements of the Orders when needed.

The Orders also established the International Saint Lawrence River Board of Control (ISLRBC) and provide 11 criteria for managing flows through the project. The first ten of these criteria, including the upper limit of the four-foot range for Lake Ontario water levels, are to be met when water supplies to Lake Ontario are within those experienced during the period of record (1860-1954). The eleventh criterion (called criteria k) applies when water supplies are higher or lower than those experienced during this period. When higher, the outflow from Lake Ontario is to be regulated to provide all possible relief to both upstream and downstream property owners. When supplies are less than those during the period of record, the outflow is to be regulated to provide all possible relief to navigation and power interests. The full text of the 1956 Orders of Approval, including the 11 criteria, is available online.

3.2.5 Are Orders of Approval ever updated?

Yes, the IJC systematically reviews its Orders of Approval for the projects it has approved along the Canada-United States boundary. As part of this process, the IJC appointed an International Lake Ontario-St. Lawrence River Study Board, which completed an extensive five-year study in March 2006. A potential new approach for regulating water levels and flows is being discussed by a Lake Ontario-St. Lawrence River Working Group, which was convened in December 2009 to provide advice to the IJC. The Working Group includes members from Canada, the United States, New York, Ontario, Quebec, and the IJC. Any potential changes to the Orders of Approval represent very complex discussions weighing numerous factors such as environmental, municipal, hydropower, riparian, navigation, and recreational interests and climatic changes.

3.2.6 How does the IJC engage the public?

The IJC holds public hearings and involves the public in other ways whenever it initiates a study or reviews a dam or other structure for possible approval. IJC boards that monitor the operation of these structures, such as the International St. Lawrence River Board of Control, also hold regular public meetings. The IJC also occasionally sponsors other conferences, meetings, and round-table discussions, in which members of the public and representatives of community groups and other organizations can take part. Notices and information materials are produced on various topics; these materials and Commission reports are available online and from the IJC offices.

3.3 International St. Lawrence River Board of Control

3.3.1 What is the ISLRBC?

The International St. Lawrence River Board of Control (ISLRBC) is the body that oversees the regulation of water levels and flows in Lake Ontario and the St. Lawrence River consistent with the requirements established by the IJC. When the IJC approved the international hydropower project in the St. Lawrence River, it appointed the ISLRBC to develop and operate a regulation plan to determine flows through the project that are consistent with the Orders of Approval. The Board now oversees the regulation and ensures that the requirements set by the IJC in its Orders of Approval are followed.

3.3.2 Who is on the ISLRBC?

The ISLRBC has ten members: five from each country. Current membership can be found on the Board's website. Members are not paid for the time they devote to ISLRBC activities beyond any salaries they receive from their employer if they are employed by another institution. The members bring a variety of technical and local knowledge to Board discussions.

3.3.3 How are members of the ISLRBC appointed?

Members of the ISLRBC are appointed by the International Joint Commission. Appointments are based on members' technical background and knowledge of the Lake Ontario-St. Lawrence River system. Board members are appointed to serve impartially in their personal and professional capacities, not as representatives of particular agencies, interests or geographic regions.

3.3.4 Does the ISLRBC take formal votes on its decisions?

Similar to the IJC, the ISLRBC operates by consensus rather than by taking formal votes. The Board discusses the probable outcomes of various courses of action, the views expressed by individual members, and input from the public, until consensus is achieved. If consensus is not reached, additional information and discussion may be required to reach an informed solution.

3.3.5 What is done to ensure that the public has input into ISLRBC decisions?

The ISLRBC actively engages the public through various means including public meetings, public teleconferences, and briefings for stakeholder organizations, news media, and elected officials. The Board also receives and responds to phone calls, letters, and e-mail messages.

3.3.6 Are records of ISLRBC decisions accessible to the public?

Yes, the ISLRBC announces its flow strategy decisions, including the rationale for reaching those decisions in their press releases and posts this information on its website along with the minutes of its meetings and the weekly Lake Ontario outflow. Members of the public can also join an e-mail list to receive weekly e-mail updates on recent water levels and flows.

3.3.7 How does the Board increase public awareness of water and weather conditions?

The ILSRBC holds public teleconferences twice a year (usually on the third Tuesday in March and September) and distributes informative announcements on a regular basis to media outlets and which are posted on its website. The ISLRBC reaches out to news media, elected officials, stakeholder organizations and its own contact lists to increase public awareness of such information. We encourage others to spread the information and will include anyone who is interested in our regular distributions. ISLRBC members and our Facebook page are available to promote public awareness.

3.4 Operators of the Dam

3.4.1: Who actually operates the dam at Cornwall, Ontario and Massena, New York?

Ontario Power Generation owns and operates the Canadian side of the dam, and the New York Power Authority owns and operates the U.S. side of the dam, both under the direction of the Board. They ensure that outflows follow the releases prescribed by the Plan, as directed by the Board's strategy and authority for discretionary deviations.

3.4.2: What is the Operations Advisory Group (OAG)?

The Operations Advisory Group consists of navigation and hydropower representatives who provide advice on the impact of the weekly outflows to their respective operations. A different flow than that prescribed by the regulation plan or as directed by ISLRBC's strategy may be recommended by the OAG due to operational considerations and constraints; however, any such recommendation is subject to approval by the Board.

4. Regulation

4.1 What does the ISLRBC regulate?

The ISLRBC regulates Lake Ontario outflows, ensuring they meet the requirements of the Commission's Orders of Approval. The Board operates under the current regulation plan (Plan 1958-D) and conducts special studies as requested by the Commission. This regulation plan reflects the natural rhythms of the Lake Ontario-St. Lawrence River System. Though the ISLRBC regulates outflows, the system is primarily influenced by natural processes, such as inflow from Lake Erie, weather patterns, and wind (see Section 1, "Influences on Water Levels and Flows").

4.2 How does the ISLRBC go about regulation?

The Board reviews the hydrologic and water level conditions and sets a regulation strategy through meetings that occur on at least a monthly basis. The regulation strategy generally consists of a directive to the operators to release flows as specified by the regulation plan or to deviate from the plan flows. If deviations are authorized, specific flow rates and their duration above or below the plan flow are prescribed, when possible. In many cases, deviations are authorized only if certain water level or flow conditions are encountered and only up to specific limits.

On the basis of the Board's regulation strategy, the Board regulation representatives consult with the Operations Advisory Group (OAG) on a weekly basis (each Thursday) and direct that the flow be adjusted to the required rate, effective Saturday morning of each week (typically). In the case of unusual events, emergencies, and/or disputes over the flow rate between the regulation representatives and the OAG, the Board will be asked to meet on an emergency basis through a teleconference or via electronic means.

4.3 Who are the Regulation Representatives and what are their duties?

There are two Regulation Representatives that carry out the day-to-day regulation activities of the Board. The Board's American Regulation Representative is the District Engineer at the

Corps of Engineers' Buffalo, New York office, and its Canadian representative is the Manager of the Great Lakes - St. Lawrence Regulation Office of Environment Canada in Cornwall, Ontario. Regulation Representatives have strong technical backgrounds and are typically professional engineers. They are supported by a team of water management engineers and technical experts. Among other duties, the Regulation Representatives:

- Perform the weekly regulation computations according to the regulation plan.
- Advise the Board on potential regulation strategies (including any discretionary deviations) and ice management.
- Ensure that regulation operations follow the Board's adopted strategy.
- Act on behalf of the Board in emergency situations where immediate decisions to change flows may be needed.
- Collect and evaluate water level, flow, ice, and hydro-meteorological data related to outflow regulation.
- Act as the Board's technical liaison and monitor and coordinate flow regulation activities with navigation and hydropower entities.
- Provide expert technical advice and data (e.g., water level and outflow data and forecasts, datasets, statistics, etc.) to stakeholders, the public and media.
- Undertake studies and analyses as necessary to improve and facilitate regulatory operations and decisions.
- Ensure the accuracy of reported water level and flow data relevant to regulatory operations.

4.4 What are the criteria that the Board uses in making management (regulation) decisions?

The 1956 Orders of Approval provide 11 criteria for setting flows through the project. They address:

- regulated outflows from Lake Ontario and their effect on the minimum level of Montréal Harbour,
- outflows during the annual spring ice break up in Montréal Harbour and during the annual flood discharge from the Ottawa River,
- minimum regulated outflows to secure the maximum dependable flow for power generation, and
- both upper and lower target levels for water levels on Lake Ontario.

These criteria are to be met when water supplies to Lake Ontario are within those experienced during the period of record (1860-1954). When water supplies are higher than those experienced during this period, the outflow from Lake Ontario is to be regulated to provide all possible relief to upstream and downstream property owners. When supplies are less than those during this period, the outflow is to be regulated to provide all possible relief to navigation and power interests. The full text of the 1956 Orders of Approval, including the 11 criteria, is available online.

4.5 What other regulations and standards does the ISLRBC use in making its decisions?

The current regulation plan (Plan 1958-D) determines outflows that meet the criteria established under the Orders of Approval. The IJC has also granted the Board of Control the authority to

release flows that deviate from those specified by the Plan if the Board determines that such deviations will provide benefits to one or more interests without resulting in any significant negative impacts to other interests. Except in the case of extremely high or low water supplies, the deviations authorized by the Board are generally small in magnitude, short in duration, and are often offset with equal and opposite flow changes as soon as conditions permit.

4.6 What authority does the ISLRBC have to consider individual interests when setting Lake Ontario outflows?

In 1961, the IJC gave discretionary authority to the ISLRBC to depart temporarily from the regulation plan flow when a deviation would provide relief from adverse impacts to any interest without appreciable adverse effects to any of the other interests. At various times, this authority is used to assist shoreline property owners, recreational boaters, navigation, hydropower, and other interests.

4.7 What actions do the IJC and ISLRBC take to react to low water supplies and avert extreme low water levels in Lake Ontario or the St. Lawrence River?

The criteria and regulation plan aim to maintain Lake Ontario levels above 74.15 m (243.3 ft.) from April 1 through November 30, even under very dry conditions. The operating plan was designed to reduce outflows as conditions become drier, within defined limits. When conditions permit, the Board may deviate from the plan in order to reduce outflows even further (i.e., store water for even drier times) or to increase outflows (i.e., to release water to meet a specific short-term need). Under the most extreme dry conditions, all possible relief is provided to affected interests specified by the Orders of Approval.

4.8 Can water be stored on Lake Ontario to provide a buffer against low water conditions in the Thousand Islands and/or Montréal?

Yes. In doing so, however, relevant interests need to be considered and balanced, such as water levels in the Thousand Islands and/or Montréal are considered along with other interests. In such a system, no one interest can be perfectly satisfied all the time to the detriment of all other interests.

4.9 Are there ways to address low water problems other than through regulating water levels?

Yes. The design and siting of water intakes and recreational boating facilities should take into account the entire range of water levels to be expected. In general, no Federal, N.Y. State, Ontario Provincial, or Quebec Provincial regulations have been implemented to assure that adequate designs are used. For recreational boating facilities, adequate investment in dredging, including securing necessary permits, is also effective in dealing with low water levels that should be expected to occur on occasion as a result of low water supplies.

4.10 Should low water conditions continue for a number of years, what are the implications to the Board's approach to controlling water levels and to water users above and below the Moses-Saunders Dam?

Under the current Order of Approval (1956), the ISLRBC follows the regulation plan, known as Plan 1958-D, which decreases the outflow from Lake Ontario as the level decreases subject to

a number of limits. The ISLRBC also has discretionary authority to deviate from plan flows to help one or more interests if this can be done without causing appreciable harm to other interests. Discretionary deviations are set by the ISLRBC based on a risk analysis that looks at all factors and all affected interests upstream and downstream. The outflow may be decreased under discretionary deviations to store water on Lake Ontario for future use, but such action is based on the needs and possible impacts to users both upstream and downstream. Finally, when the water supply to Lake Ontario is below a certain historical range (1860-1954), the outflow is set under “criterion k” of the Order of Approval to provide all possible relief to navigation and hydropower interests. The ISLRBC will try to share the “pain” from the dry conditions to water users both above and below the dam.

4.11 Should the Board have a contingency plan in place if “drought-like” water supply conditions continue, even though forecasted weather conditions may not predict drought-like conditions?

The use of discretionary deviations is in a way contingency planning in that the risk analysis takes possible future conditions and impacts into account. However, since the ISLRBC realizes that forecasted weather conditions are not reliable for more than a few days into the future, the risk analysis used by the ISLRBC considers the possible impacts of high, average and low water supplies in the future. History has shown that we cannot count on the continuation of a drought any more than we can count on future precipitation. It is simply not possible to predict future water supplies, so all reasonable possibilities must be taken into account.

4.12 If a multi-year trend to lower Lake Ontario water levels emerges, will the Board be able to maintain sufficiently high water levels above and below the Dam to stay above the lowest level needed to maintain Seaway operations?

The regulation of Lake Ontario outflows allows for some management of natural water supplies, some balancing of natural supplies above and below the dam, and thus for some reduction in negative impacts. No regulation plan can create water supplies, and thus no regulation plan can maintain sufficiently high water supplies above and below the dam under any multi-year trend of lower Lake Ontario water levels. When extreme high or low water supply conditions occur, the resulting water levels would also be extremely high or low under any plan. Water levels would be higher or lower to a degree under different regulation plans, but the overall trends would not be different. No regulation plan affords enough control to affect the overall trends.

4.13 What adaptive measures should water users and property owners be taking above and below the Dam to protect against adverse impacts, and will the Board be taking actions to encourage such measures to be implemented?

The ISLRBC always encourages water users and property owners to plan for the full range of water levels that have been experienced historically. Recommending specific adaptive measures is beyond the purview of the ISLRBC, but information on this topic is readily available, including in some of the agency publications provided on the publications page of the ISLRBC website.

4.14 Doesn't knowing the snow pack provide a reliable indicator of the water supplies for the spring and summer season?

Since on average 80% of the water coming into Lake Ontario comes from Lake Erie, the correlation between the snow pack in the local drainage basin of the lower lake and its subsequent spring and summer level is very low. Most of the water coming into Lake Ontario at any one time is not from precipitation over its local drainage basin and the lake itself, but is flowing over Niagara Falls from Lake Erie. Even Lake Erie receives on average 78% of its water supplies from the Great Lakes above it; therefore the snowpack in its local drainage basin is an unreliable indicator of spring and summer water supplies. In fact, on the Ottawa River, where the snow pack is a better indicator of the spring freshet, so many other factors come into play in determining the peak flow, that the correlation is still not perfect. Other factors include how frozen the ground is when the snow melts, how dry the soil is, how fast the snow melts and whether the snow sublimates, that is evaporates directly from snow into water vapour without first turning into water. Most crucial is whether it rains at the same time as the snow is melting, this generates the most runoff.

4.15 Can Lake Ontario water levels be reduced in the fall of each year to provide a buffer against high water supplies the next spring?

Yes. In doing so, however, relevant interests need to be considered and balanced, such as water levels in the Thousand Islands and/or Montréal are considered along with other interests. Reductions in fall levels can result in negative environmental consequences for water-level dependent wildlife and fish species that use wetlands throughout the fall, winter, and spring periods. In the Lake Ontario – St. Lawrence River system, no one interest can be perfectly satisfied all the time to the detriment of one or all other interests.

4.16 What is criterion (k) and what triggers it during high or low water conditions?

Criterion (k) allows for flexibility as part of the IJC's Orders of Approval for the St. Lawrence project. It is triggered when extreme high or low water supplies occur that are outside the range that was used to design the regulation plan. Based upon the supplies received and all other factors occurring at the time, the Board may recommend to the IJC that criterion (k) be invoked. Once invoked by the IJC, operations under criterion (k) commence, subject to any conditions that the IJC may impose.

- Under extreme high supplies, criterion (k) provides that all possible relief be given to riparian property owners upstream and downstream of the project.
- Under extreme low supplies, criterion (k) provides that all possible relief be given to domestic and sanitation, hydropower, and navigation interests.

If water supplies are higher, the Board may be directed by the Commission to release flows to provide relief to riparian interest upstream and downstream of the project. If water supplies are lower, the Board may be directed by the Commission to release flows to provide relief to domestic and sanitary, navigation and hydropower interests. The authority for the Board to operate according to criterion (k) has to be specifically directed by the IJC, typically following a recommendation from the Board. Historically, the Board has considered several factors when

recommending that the IJC invoke criterion (k), including the recent and forecast supplies to the lake, the current level of the lake, the chance of exceeding the criterion (h) or (j) levels, the amount of snowpack on the basin, soil moisture conditions, and other hydrologic factors.

The Board does not wait until water levels have exceeded the upper or lower limits before recommending implementation of criterion (k). As specified in the Orders of Approval, the use of criterion (k) is predicated on the receipt of water supplies to the system that exceed those experienced prior to the development of the current regulation plan, Plan 1958-D. The Board continually monitors the supplies received and anticipated in the near future and compares them to the maximums and minimums received prior to 1955 in order to determine if the supplies have or can reasonably be expected to exceed the maximums or minimums as recorded prior to 1955.

4.17 What is criterion (h)?

Criterion (h) sets an upper limit for Lake Ontario. It expresses the IJC's intention that with regulation the monthly mean levels of Lake Ontario be below the elevation of 75.37 metres (247.3 feet - IGLD 1985) when water supplies are within the range seen before the construction of the project.

4.18 What is criterion (i)?

Criterion (i) expresses the IJC's intention that monthly mean levels above the elevation 75.07 metres (246.3 feet - IGLD 1985) not occur more frequently with regulation than would have occurred prior to the project with the same water supplies. Criterion (i) keeps water levels from being maintained near the top of the regulation range.

4.19 Why doesn't the Commission use criterion (i) as the upper limit for water level regulation on Lake Ontario?

Criteria (a) through (k) were developed as a total package that is workable given water supplies within the range of those experienced before the project was built. This set of criteria includes criterion (i), which specifies that the frequency of monthly mean elevations of approximately 75.07 m (246.3 ft) or higher shall be reduced. The target upper limit for Lake Ontario water levels is specified in criterion (h) as 75.37 m (247.3 ft). Treating the criterion (i) level as an upper limit would be equivalent to narrowing the target range of levels by one foot. This would be a significant change to the Orders of Approval which would make the other criteria more difficult, and perhaps impossible, to achieve.

5. Impacts on Various Interests

5.1 General

5.1.1 What is the value of high water? Who is impacted?

High water levels generally benefit municipal water users, shipping, hydro-electric generation, and recreational boaters. They negatively impact riparian owners by overtopping fixed docks or flooding buildings close to the water's edge. In addition, shoreline erosion rates are often

greater with higher water levels, and shoreline protection structures can be damaged with extreme high water levels. Wetlands extend further inland with higher water and are inundated to greater depths, which is beneficial from time to time. Periodic high water levels are necessary to sustain wetland productivity and health.

5.1.2 What is the value of low water? Who is impacted?

Low water levels impact municipal users as the water intakes may be above the water surface or affected by warmer and poorer quality water. Low water levels result in less water available for dilution of municipal waste water, or increased cost for treatment. Shipping and boaters are adversely affected by low water as channels are shallower. Ships may need to lighten their load to decrease the draft and recreational boaters may find that docks or launches do not extend sufficiently far. Hydro-electric generation is affected by lower available head or lower flows.

Low water levels benefit riparian owners whose docks may be short and low or who have buildings too close to the water's edge. Erosion rates generally decrease with lower water levels.

Periodic low summer water levels can also result in positive environmental benefits. Low water levels expose more beach and mudflats. Additionally, wetland vegetation may extend further into the lake and river. Wetland dewatering encourages dormant aquatic seed bed germination benefiting wetland plant species and biodiversity.

5.1.3 At what Lake Ontario level(s) do adverse impacts from low or high water occur?

Although Lake Ontario is to be regulated above 74.15 m (243.3 ft) during the navigation season and below 75.37 m (247.3 ft, both monthly means) there is no single critical low or high water level at which it can be said that "adverse impacts" occur in the system. The level of harm experienced by a user of the system greatly depends on the location and the usage and sometimes the time of the year The IJC and the Board are aware that various sectors in the system may be impacted as levels in Lake Ontario and the St. Lawrence River vary, even within their target ranges.

5.1.4 What can shoreline communities do, if anything, to assist the Board?

Shoreline communities can help the ISLRBC by communicating with us so that we understand your situation and concerns. More importantly, shoreline communities can help themselves by becoming better informed about coastal hazards and taking action to reduce their risks to such hazards, particularly through incorporating risk reduction measures into shoreline revitalization efforts and long-term planning of coastal zone uses.

5.1.5 What have been the impacts of regulation on Lake St. Lawrence compared to pre-project conditions?

Prior to the construction of the Moses-Saunders hydropower dam, the Long Sault Dam, and the associated protection structures, the St. Lawrence River upstream of the project was much narrower, containing fast-moving water and rapids, and was subject to ice jams and associated flooding. Construction of the seaway and power project stabilized flows and created Lake St. Lawrence, which is the large headwater pond upstream of the Moses-Saunders dam. The wider river flooded some historic villages and farms on both sides of the river. People who lost their

homes had to relocate and many homes were moved to new sites upland. The projects also allowed for the growth of recreational boating and associated businesses in this area. Without the Moses-Saunders project and associated regulation, much of the St. Lawrence River between Ogdensburg and Massena, N.Y. would not be navigable for commercial or recreational vessels - except for canoes, kayaks, and rafts.

5.1.6 What water level information is available?

As water levels affect many interests, perhaps one of yours, the Board has many ways to communicate water levels in the system. The data page of our website indicates current and recent levels and allows users to subscribe to a list-serve for announcements. The publications page lists news releases. The Board posts weekly updates of levels and flows (In the U.S., the number is 1-800-883-6390, and in Canada the numbers are 1-800-215-8794 (English) and 1-800-215-9173 (French), or visit the board website.

The Board encourages everyone to be aware of water levels and to be prepared to live within the range of levels specified in the Orders of Approval. For Lake Ontario, the upper limit for monthly mean levels is 75.37 m (247.3 ft) and the lower limit (from April to December) is 74.15 m (243.3 ft), a range of 1.22 m (4 ft). Levels on the river tend to vary more widely.

5.2 Domestic Water Supplies and Sanitary Uses

5.2.1 How can high or low Lake Ontario water levels affect domestic and sanitary uses?

High water levels can threaten domestic water supplies and sanitary uses. These consist of flooding and backup of sanitary sewer lines, flooding and contamination of freshwater storage wells, and under very high levels or during storm events, possible flooding of freshwater intake pumping facilities.

Very low water level conditions may affect shore wells and municipal and industrial water intakes on the St. Lawrence River and along the entire Lake Ontario shoreline. Such impacts can be avoided through proper design of such facilities with anticipation of the entire range of Lake Ontario levels and flows prescribed by the Orders of Approval and those that occur on the St. Lawrence River.

5.3 Commercial Navigation

5.3.1 How can the regulation of Lake Ontario outflows impact commercial navigation?

The construction of the Seaway and power project opened the Great Lakes to ocean-going navigation. Outflows exceeding design limits in the regulation plan can result in severe water velocities and cross-currents in the river, which can occur at key points such as at entrances to navigation locks. In addition, very high flows at the Moses-Saunders hydropower dam reduce the available draft on Lake St. Lawrence, immediately above the dam, due to a drawdown effect at the dam and immediately upstream.

By contrast, very low outflows can result in extremely low levels in downstream areas of the Seaway and at Montréal Harbour, limiting the ability of vessels to transit the channels and/or approach docks. Under certain conditions, shippers may have to lighten their vessels, forcing them to either leave cargo behind or increase the number of transits necessary.

5.3.2 Are navigation interests impacted by Lake Ontario water levels?

Yes. While high water levels on Lake Ontario can produce benefits for navigation, they often mean higher flows in the St. Lawrence River, which can have negative impacts. For example, higher flows can produce cross-currents that cause difficulty in controlling the vessels. Low levels can also be hazardous to navigation and can result in ship groundings. Shippers may have to lighten their vessels, forcing them to either leave cargo behind or increase the number of transits necessary.

5.3.3 Can the navigation season between Lake Ontario and Montréal close earlier so more water can be let out of Lake Ontario?

The Commission does not specify either the start or the end of the navigation season. This season is jointly determined by the St. Lawrence Seaway Management Corporation in Canada and by the St. Lawrence Seaway Development Corporation in the United States. The regulation of outflows in accordance with the Boundary Waters Treaty and the IJC's Orders of Approval, however, does take into account navigation.

5.4 Hydropower

5.4.1 Do hydropower interests benefit from high Lake Ontario outflows?

For hydropower, more electricity can usually be generated when there is a greater volume of water passing the stations. However, the consequent lowering of upstream levels decreases the head on the hydropower stations, thereby decreasing the amount of electricity generated for a given volume of water. Finally, extremely high outflows may exceed the capacity of the hydroelectric facilities, resulting in water being diverted around the generating equipment and being lost in terms of power generation.

5.4.2 When the Board increases outflows from Lake Ontario is the water spilt or is it still used to generate electricity?

The generating capacity of the Moses Saunders dam is around 10 000 m^3/s when all units are available under typical conditions. Since the average outflow is 7 000 m^3/s, the water is not spilt when outflow is increased, especially during dry conditions when the outflows are increased to augment low levels downstream. The water passes through the generators. The spillway at Long Sault dam was last used in 1998.

5.5 Environment

5.5.1 What authority does the ISLRBC have to consider the environment when setting Lake Ontario outflows?

The 1956 Order did not include consideration of the environment. Thus, the Board has had no direct authority to consider it in its deliberations. In 2009, The IJC asked the Board to consider the environment within the context of the existing Order. The Board has determined that there is little it can do to benefit the environment on Lake Ontario through its deviation authority but that there might be some limited benefits that could be achieved in specific instances in the St. Lawrence River.

5.5.2 Has regulation had an adverse impact on wetlands due to the reduction of the occurrence of extreme high and low water levels on Lake Ontario?

Yes, the Lake Ontario-St. Lawrence River study concluded that regulation has had a negative impact on the wetlands and wetland-supported habitats of the Lake Ontario-St. Lawrence River Basin. While each wetland is unique, narrowing the range of water level fluctuations generally results in less wetland acreage and less diversity within the wetland plant communities. The Commission's Levels Reference Study Board concluded in 1993 that the reduction in the range of water level fluctuations resulting from regulation has adversely affected the extent and diversity of Lake Ontario's wetlands. It also concluded that altering natural water level conditions on Lake Ontario resulted in the appearance of undesirable plant species in its wetland habitats and has limited the capability of wetlands to support the overwintering water-dependent fish and wildlife populations. Further, there is also concern regarding the environmental impact of outflow regulation on wetland and fishery habitats in downstream areas of the river. More definitive data regarding all these impacts has been provided by studies conducted by the Lake Ontario-St. Lawrence River Study for the IJC from 2000 to 2006.

5.5.3 How has regulation impacted the environment upstream of the project at Massena and Cornwall?

The construction of the dam at Massena and Cornwall created Lake St. Lawrence immediately upstream, thus changing the nature of that environment from a river to a lake environment. That change has brought about physical, chemical, and biological modifications. There are also concerns regarding impacts from the use of the shipping channel.

5.5.4 How has regulation impacted the environment downstream of the project?

Regulation has reduced the number and, perhaps more critically, the timing and duration of extreme high and low levels on the river downstream. This may have impacted both wetland and fishery habitats. More definitive data regarding all these impacts has been provided by studies conducted by the Lake Ontario-St. Lawrence River Study for the IJC from 2000 to 2006.

5.6 Riparian and Shoreline Property Owners

5.6.1 What factors affect shoreline flooding and erosion?

The major factors affecting long-term erosion rates include shoreline materials and structure, long-term patterns of sediment transport along the shore, and water levels. These factors have caused erosion since the last ice age and will continue to cause erosion in the future.

Strong winds are responsible for significant erosion over short time periods. When water levels are high, wind-driven waves can trigger significant short-term erosion events that would otherwise occur later or more gradually. They may also direct wave energy against existing erosion protection structures, sometimes resulting in damage. With extremely high water levels, waves may also directly impact on and damage dwellings and other structures near the shoreline. High water levels also result in localized flooding of roads and other public facilities and may result in damage to private property as well as public water and sewage facilities. The Lake Ontario-St. Lawrence River study found that damages to shoreline property and shoreline protection structures increases with increasing mean water levels on Lake Ontario. While long-term recession rates appear to be independent of water level fluctuations for some Great Lakes

shoreline areas, water level fluctuations do play a role in determining long-term recession in others. The water level fluctuations may also influence beneficial shoreline sand redeposition and sand dune replenishment. More definitive data regarding all these impacts has been provided by studies conducted by the Lake Ontario-St. Lawrence River Study for the IJC from 2000 to 2006.

5.6.2 What have been the benefits to St. Lawrence River riparian property owners as a result of Lake Ontario regulation?

Timely management of the Lake Ontario outflows has consistently prevented extremely high water levels and flooding in the Montreal region. Regulation of Lake Ontario outflows has also greatly reduced the incidence of ice jams in the river, both upstream and downstream of the Cornwall/Massena area, thus reducing the flooding and shoreline damage often associated with these events. Finally, the construction of the St. Lawrence Seaway and power project created conditions enabling the establishment and growth of recreational boating on many areas of the St. Lawrence River. This occurred through the elimination of rapids, the creation of Lake St. Lawrence immediately above the dam, and the stabilization of river flows and water levels.

5.6.3 Are there ways to address flooding and erosion problems other than through regulating water levels?

While shoreline protection may be effective in some instances, the best way to address flooding and erosion problems is through effective shoreline management. This is primarily a local, state, or provincial government function. The New York State Department of Environmental Conservation regulations pursuant to the N.Y. State Coastal Erosion Hazard Act implement several actions to reduce flooding and erosion losses along the Lake Ontario shoreline. The Provinces of Ontario and Quebec address flooding and erosion problems with flood plain management measures that provide easements and restricted building zones along the shore.

Actions by the NYSDEC and the Provinces of Ontario and Quebec that have been found to be effective include:

- For new structures, flood and erosion setbacks that consider the long-term recession rates;
- Prohibitions on removing or damaging natural shoreline protective features such as bluffs and dunes;
- Prohibitions of any construction or structures within flood hazard areas;
- Relocation of structures at risk;
- Real estate disclosure requirements;
- Acquisition of high-risk undeveloped land;
- Limiting construction in flood plains; and
- Purchase of flood easements within flood plains.

5.6.4 What can I, as a landowner, do to protect myself from high water damages to my property? What can the Board do to help me?

As a landowner, it is important to build with the knowledge that water levels fluctuate, and to know the extremes possible at your location. The Board urges everyone to be prepared to live within the full range of levels that have occurred. The Board strives to maintain the range of

monthly mean levels of Lake Ontario below the upper limit of 75.37 m (247.3 ft) and above the lower limit (from April to December) of 74.15 m (243.3 ft) specified in the Orders of Approval. Know the extent to where high water and winds act and build accordingly. Structures, such as breakwaters and heavy stone may protect against strong wind action if built correctly. Residences should be built with sufficient setback to avoid flood and erosion damages into the future. The Board announces weekly levels and flows on the telephone and via e-mail; you may sign up to receive the e-mail bulletins or call the 1-800 number. The Board's website also has guidelines on its publication page.

5.7 Recreational Boating

5.7.1 Other than water level regulation, are there any actions that could benefit recreational boaters?

Recreational boaters have problems navigating at different points on the lake and on the river, even when levels and flows are within the ranges in the Order. For example, a private dock or a marina built during high water levels may not be fully usable when water levels fall. Therefore, one action to alleviate this is to site, design, and maintain new and existing recreational boating facilities - taking into account the full range of water levels and flows, at minimum as defined in the Orders of Approval for Lake Ontario and as have occurred along the St. Lawrence River. This may necessitate the use of longer launch ramps, floating (rather than fixed) docking systems, and the financial commitment and permits to perform periodic maintenance dredging as needed to accommodate the planned use. Also, it must be recognized that some areas are shallow and cannot accommodate dockage for large recreational vessels. In addition, boaters should pay particular attention to navigation charts during low water periods, even in waters with which they may be familiar.