Regulation Plan 2014 for Lake Ontario and the St. Lawrence River

Compendium Document

December 2016

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[SIGNED DOCUMENT TO FOLLOW]

INTERNATIONAL JOINT COMMISSION
IN THE MATTER OF THE REGULATION
OF THE LEVEL OF LAKE ONTARIO

SUPPLEMENTARY ORDER OF APPROVAL

December 2016

WHEREAS:

On October 29, 1952, the International Joint Commission issued an Order of Approval, pursuant to the Boundary Waters Treaty of 1909 (the "Treaty), to the Government of Canada and the Government of the United States of America for the construction, maintenance and operation of certain structures for the development of power in the International Rapids Section of the St. Lawrence River. This Order was amended by a Supplementary Order dated July 2, 1956 (1956 Order);

The Commission retained jurisdiction in the 1952 Order, as supplemented by the 1956 Order, to make further Order or Orders regarding the subject matter of the governments' applications, after giving notice and an appropriate opportunity to all interested parties to make representations to the Commission;

A 1993 Commission Great Lakes Levels Reference Study recommended that the Orders of Approval for the regulation of Lake Ontario be revised to better reflect the current needs of the users and interests of the system. In letters dated April 15, 1999, the Commission informed the Governments of Canada and the United States that it was becoming increasingly urgent to review the regulation of Lake Ontario levels and outflows. In response the Governments funded a five-year Lake Ontario-St. Lawrence River Study (2001-2006). The study focused on impacts of water level regulation, water supply conditions including potential climate change scenarios, a wide range of alternative regulation plans and the 1956 Order. The Study found that water supplies to Lake Ontario since regulation began under the 1956 Order have been significantly above and below those experienced during the 1860-1954 period of record;

The Commission has now completed a review of the 1956 Order. This review of the regulation of Lake Ontario and the St. Lawrence River culminated in a proposal to modify the existing Orders of Approval and presentation of a new regulation plan. Technical hearings, which were open to the public and featured expert testimony from invited experts, and public hearings on this proposal were held by the Commission in order to provide all interested parties with a convenient opportunity to be heard, in accordance with the Treaty. The following hearings were held: Lockport, New York on July 14, 2013; Toronto and Jordan, Ontario on July 15, 2013;

Rochester and Williamson, New York on July 16, 2013; Oswego and Alexandria Bay, New York on July 17, 2013; Montreal, Quebec on July 18, 2013; and Cornwall, Ontario on July 19, 2013; and a public hearing by teleconference on August 27, 2013. The Commission accepted comments on the recommended modifications to the operating conditions and criteria of the Order of Approval through August 30, 2013. Transcripts of the hearings and written submissions are available for public view on the Commission's website and at the Section offices in Washington, D.C., and Ottawa, Ontario;

The Commission has considered the views of the public, as expressed through testimony at the public hearings, and through other submissions, the advice of its International St. Lawrence Board of Control, and the views and comments of the Governments;

In June of 2014 the Commission submitted "Lake Ontario-St. Lawrence River Plan 2014: Protecting against extreme water levels, restoring wetlands, and preparing for climate change" to the Governments of the United States and Canada. In this report the Commission sought the concurrence of the Governments of Canada and the United States on revising the 1956 Order to consider ecosystem health with respect to all other interests and uses of the Lake Ontario-St. Lawrence River system;

The Commission sought the concurrence of the two governments to issue this Supplementary Order and such concurrence was provided with the understanding that changes to the 1952 Order, as supplemented by the 1956 Order, must comply with the terms set out in Article VIII of the Treaty;

The Commission finds that regulation under the 1956 Order is designed for past conditions and interests known at the time the 1956 Order was implemented and that the four-foot target range of elevations in the 1956 Order creates an unrealistic expectation that Lake Ontario water levels can be regulated within a four-foot range (approximately 1.2 meters). Under extreme water supply conditions, such as those experienced on several occasions since regulation began, the Commission finds it is not possible to keep the lake within the four-foot target range. Regulation as practiced under the 1956 Order has harmed the near shore Lake Ontario and upper St. Lawrence River environments by compressing water level fluctuations to much less than they would have been under unregulated conditions. Current regulation does not accurately reflect the full range of experienced conditions or anticipate future changes; and it is now necessary to also consider environmental issues and recreational boating upstream and downstream of the project;

In assessing the benefits provided by regulation under this Supplementary Order, the Commission finds that the terms, conditions and other requirements of this Supplementary

Order take into account the high and low water supplies since 1954 and other new information not available when the 1956 Order was developed;

The Commission finds that regulation under this Supplementary Order in combination with improved governance of the system and less frequent deviations from a regulation plan that encompasses a more extensive range of possible conditions will provide long-term benefits, upstream and downstream, including those identified in the 1956 Order with greater security and predictability;

The Commission finds that, in the long term, regulation under this Supplementary Order will help to restore the ecosystem health of Lake Ontario and the Upper St. Lawrence River, continue to provide benefits on the lake and upper river, and maintain the current benefits downstream;

The Commission finds that the terms, conditions and other requirements of this Supplementary Order respond to the requests made by the Governments of Canada and the United States in the joint references dated June 25, 1952, and joint applications dated June 29, 1952**,** as clarified in the joint letter of November XX, 2016;

The Commission finds that the laws in Canada, and the Constitution and laws in the United States of America, together with the provisions of this Supplementary Order, satisfy the requirements of Article VIII of the Treaty;

The Commission finds that an adaptive management approach would enable the effects of regulation in the Lake Ontario - St. Lawrence River System to be assessed and would provide a valuable source of information for future reviews. Monitoring, data collection, and assessment are necessary to validate the models upon which the regulation plan was built, to evaluate the effectiveness of regulation, to analyze the effects of other changes impacting the system (such as climate change), and to consider possible future improvements in system regulation. Any changes to this Order arising from adaptive management, as well as any changes to the regulation plan or the levels referenced in H14, would be made in accordance with Condition H.

The Commission finds that amendments to Appendix A of the 1952 Order, as supplemented by the 1956 Order, are necessary in order to include definitions and a revision to the description of the power house structures. Changes to the specifications of the works described in the 1952 Order, as supplemented by the 1956 Order, must be submitted for approval by both Governments. Per correspondence from the United States and Canadian Governments received June 17, 2014, and October 15, 2012, both Governments approve or have no objection to the replacement of six ice sluice gates on the Moses-Saunders dam with a concrete structure, as proposed by the power companies. The International St. Lawrence River Board of Control in

2011 recommended that the proposal be approved, foreseeing no significant changes to the operation of the project.

NOW THEREFORE THIS COMMISSION ORDERS AND DIRECTS:

The conditions herein provided are to be implemented in accordance with Article VIII and all other relevant provisions of the Treaty.

The conditions of the 1952 Order, as supplemented by the 1956 Order, are revised and supplemented by this Supplementary Order so as to read in their entirety as follows:

CONDITIONS

A. In accordance with the requirements of Article VIII of the Treaty, interests on either side of the International Boundary which are injured by reason of the construction, maintenance and operation of the works shall be given suitable and adequate protection and indemnity as provided by the laws in Canada, or the Constitution and laws in the United States respectively.

B. The works shall be so planned, located, constructed, maintained and operated as not to conflict with or restrain uses of the waters of the St. Lawrence River for purposes given preference over uses of water for power purposes by the Treaty, namely, uses for domestic and sanitary purposes and uses for navigation, including the service of canals for the purpose of navigation, and shall be so planned, located, constructed, maintained and operated as to give effect to the provisions of this Order.

C. The works shall be constructed, maintained and operated in such manner as to safeguard the rights and lawful interests of others engaged or to be engaged in the development of power in the St. Lawrence River below the International Rapids Section.

D. The works shall be so designed, constructed, maintained and operated as to safeguard so far as possible the rights of all interests affected by the levels of the St. Lawrence River upstream from the Iroquois regulatory structure and by the levels of Lake Ontario and the lower Niagara River; and any change in levels resulting from the works which injuriously affects such rights shall be subject to the requirements of paragraph A relating to protection and indemnification.

E. The hydro-electric plants approved by this Order shall not be subjected to operating rules and procedures more rigorous than are necessary to comply with the provisions of the foregoing paragraphs B, C and D.

F. Before Ontario Power Generation or any successor make any changes to any part of the works, which would fall within the scope of Article III of the Treaty, it shall submit to the Government of Canada, and before the New York Power Authority makes any changes to any part of the works, which would fall within the scope of Article III of the Treaty, it shall submit to the Government of the United States, for approval in writing, detailed plans and specifications of that part of the works located in their respective countries and details of the program of construction thereof or such details of such plans and specifications or programs of construction relating thereto as the respective Governments may require. Following the approval of any plan, specification or program, if Ontario Power Generation or the New York Power Authority wishes to make any change therein, it shall first submit the changed plan, specification or program for approval in a like manner.

G. A Board to be known as the International Lake Ontario-St. Lawrence River Board (hereinafter referred to as the "Board") consisting of an equal number of members from Canada and the United States, to include representatives of the Canadian and United States federal governments, shall be established by the Commission. The Board shall include, but is not limited to, at least one member each nominated by the State of New York, the Province of Quebec, and the Province of Ontario. The duties of the Board shall be to give effect to the instructions of the Commission as issued from time to time in accordance with this Order. The duties of the Board shall be to ensure that the provisions of the Order relating to water levels and the regulation of the discharge of water from Lake Ontario as herein set out are complied with, and Ontario Power Generation and the New York Power Authority shall duly observe any direction given them by the Board for the purpose of ensuring such compliance. The Board shall report to the Commission at such times as the Commission may determine. In the event of any disagreement among the members of the Board which they are unable to resolve, the matter shall be referred by them to the Commission. The Board may, at any time, make representations to the Commission in regard to any matter affecting or arising out of the terms of the Order with respect to water levels and the regulation of discharges and flows.

H. The discharge of water from Lake Ontario shall be regulated by the Board (following the Commission's directives) to meet the requirements of conditions B, C, and D hereof and shall be regulated within a range of levels as specified in the below listed criteria, as nearly as may be. The project works shall be operated in such a manner as to provide no less protection for navigation and riparian interests downstream than would have occurred under pre-project conditions and with the 1900 to 2008 adjusted supplies and conditions specified in the basis of comparison. The Commission shall adopt a regulation plan, subject to the concurrence of Canada and the United States, and associated operational guides for the discharge of water from Lake Ontario and its flow through the International Rapids Section of the St. Lawrence River that satisfy the criteria and conditions of this Order, with criterion "H14" governing principles of relief should specified high or low levels be experienced. The flow of water through the

International Rapids Section of the St. Lawrence River in any period shall equal the discharge of water from Lake Ontario as determined for that period. The Commission may adopt new regulation plans from time to time provided they are in accordance with this Order, and subject to the concurrence of Canada and the United States.

Criteria

H1. The regulated outflow from Lake Ontario shall be such as not to increase the frequency of low levels or reduce the minimum level of Montreal Harbour below those listed in the table below which would have occurred with the 1900 to 2008 adjusted supplies and conditions (hereinafter called the "supplies of the past as adjusted") that are defined in the document "Basis of Comparison Conditions for Lake Ontario – St. Lawrence River Regulation" .

Note: All elevations use the 1985 International Great Lakes Datum and metric system of measurement.

Montreal Jetty #1 Level IGLD1985

Meters	Feet	Number of quarter-months in 1900-2008 below level
5.55	18.21	811
5.50	18.21	679
5.40	17.72	366
5.30	17.39	153
5.20	17.06	83
5.10	16.73	45
5.00	16.40	15
4.90	16.08	1
4.80	15.75	1
4.70	15.42	minimum

H2. The regulated outflow from Lake Ontario shall be such as not to increase the frequency of low levels or reduce the minimum level of Lake St. Louis below those listed in the table below which would have occurred with the supplies of the past as adjusted.

Lake St. Louis at Pointe Claire Level IGLD1985

Meters	Feet	Number of quarter-months in 1900-2008 below level
20.70	67.01	735

20.60	67.58	161
20.50	67.26	87
20.40	66.93	21
20.30	66.6	2
20.20	66.27	1
20.10	65.94	0
20.10	65.94	minimum

H3. The regulated outflow from Lake Ontario shall be such that the frequencies of occurrence of high water levels on Lake St. Louis as measured at the Pointe Claire gauge are not greater than those listed below with supplies of the past as adjusted.

Lake St. Louis at Pointe Claire Level IGLD1985

Meters	**Feet**	**Number of quarter-months in 1900-2008 above level**
22.50	73.82	0
22.40	73.49	9
22.33	73.26	15
22.20	72.83	51
22.10	72.51	97
22.00	72.18	221
22.48	73.75	maximum

H4. The regulated monthly mean level of Lake Ontario shall not exceed the following elevations (IGLD85) in the corresponding months with the supplies of the past as adjusted.

Lake Ontario Level IGLD1985

Month	**Meters**	**Feet**
January	75.26	246.92
February	75.37	247.28
March	75.33	247.15
April	75.60	248.03
May	75.73	248.46
June	75.69	248.33
July	75.63	248.13
August	75.49	247.67
September	75.24	246.85
October	75.25	246.88

November 75.18 246.65
December 75.23 246.82

H5. The regulated winter outflows from Lake Ontario shall be maintained so that the difficulties of river ice management for winter power operation are minimized in the International Rapids Section of the St. Lawrence River and the outlet of Lake St. Francis.

H6. Under regulation, the frequency of occurrences of monthly mean elevations of approximately 75.07 meters (m), 246.3 feet (ft) IGLD 1985 and higher on Lake Ontario shall not be greater than would have occurred with supplies of the past as adjusted and with pre-project conditions.

H7. The regulated monthly mean water levels of Lake Ontario, with supplies of the past as adjusted shall not be less than the following elevations (IGLD 1985) in the corresponding months.

Lake Ontario Level IGLD1985

Month	**Meters**	**Feet**
January	73.56	241.34
February	73.62	241.54
March	73.78	242.06
April	73.97	242.68
May	74.22	243.50
June	74.27	243.67
July	74.26	243.64
August	74.15	243.27
September	74.04	242.91
October	73.83	242.22
November	73.67	241.70
December	73.57	241.37

H8. Consistent with other requirements, the outflow from Lake Ontario shall be regulated so as to maintain levels necessary for navigation in the Montreal to Lake Ontario section of the St. Lawrence River.

H9. Consistent with other requirements, the maximum regulated outflow from Lake Ontario shall provide safe velocities for Seaway navigation and minimize spill at the hydropower facilities in the St. Lawrence River.

H10. Consistent with other requirements, the minimum regulated monthly outflow from Lake Ontario shall be such as to secure the maximum dependable flow for power.

H11. Consistent with other requirements, the levels of Lake Ontario shall be regulated for the benefit of property owners on the shores of Lake Ontario in the United States and Canada so as to reduce extremes of stage which have occurred under pre-project conditions and supplies of the past as adjusted on Lake Ontario.

H12. Consistent with other requirements, the outflow from Lake Ontario shall be regulated to help restore ecosystem health by providing for more natural variations of water levels on Lake Ontario and on the St. Lawrence River.

H13. Consistent with other requirements, the outflow from Lake Ontario shall be regulated so as to benefit recreational boating on Lake Ontario and on the St. Lawrence River.

H14. In the event that Lake Ontario water levels reach or exceed high levels, the works in the International Rapids Section shall be operated to provide all possible relief to the riparian owners upstream and downstream. In the event that Lake Ontario levels reach or fall below low levels the works in the International Rapids Section shall be operated to provide all possible relief to municipal water intakes, navigation and power purposes, upstream and downstream. The high and low water levels at which this criterion applies, and any revisions to these levels, shall be subject to the concurrence of Canada and the United States and shall be set out in a Commission directive to the Board.

I. The Commission's directives to the Board shall make provision for peaking and ponding operations and for deviations from the plan of regulation to address such matters as navigation needs, hydropower plant maintenance, winter operations, emergencies and other special short-term situations, any of such deviations being subject to review by the Commission upon its request.

J. Subject to the requirements of conditions B, C, D and H hereof, the Board, after obtaining the approval of the Commission, may temporarily make minor modifications or changes to the regulated outflows from Lake Ontario for the purpose of determining modifications or changes in the regulation plan that may be advisable. The Board shall report to the Commission the results of such temporary changes or modifications, together with any recommendations arising from such, and the Commission may accept or reject any such recommendations. Any changes or modifications that arise from such recommendations shall be made in accordance with Condition H.

K. The works shall be operated so that the forebay water level at the power houses does not exceed a maximum instantaneous elevation of 74.48 m (244.36 feet).

L. Ontario Power Generation and the New York Power Authority, and any successor entities, shall maintain and supply for the information of the Board accurate records relating to water levels and the discharge of water through the works and the regulation of the flow of water through the International Rapids Section as the Board may determine to be suitable and necessary, and shall install and maintain such gauges, carry out such measurements, and perform such other services as the Board may deem necessary for these purposes.

M. The installation, maintenance, operation and removal of the ice booms in the St. Lawrence River by Ontario Power Generation and the New York Power Authority, and any successor entities, are subject to the following:

1. Any significant modifications in the design or location of the booms shall require the approval of the Commission;
2. The placement and removal of ice booms shall be timed so as not to interfere with the requirements of navigation; and
3. The St. Lawrence Seaway Management Corporation and the St. Lawrence Seaway Development Corporation, and any successor entities, shall be kept informed of all such operations.

N. The Board shall report to the Commission as of 31 December each year on the effect, if any, of the operation of the downstream hydro-electric power plants and related structures on the tail-water elevations at the hydro-electric power plants approved by this Order.

O. No later than 15 years after the effective date of this Order, and periodically thereafter in consultation with the governments, the Commission will conduct a review of the results of regulation under this Order and report to Canada and the United States its findings. This review will include an assessment of the extent to which the results predicted by the research and models used to develop any approved regulation plan occurred as expected, consistent with adaptive management. The review may provide the basis for possible changes to the regulation of water levels and flows to be submitted to the Governments in accordance with condition H.

APPENDIX A to the October 29, 1952, Order is amended by the addition of the below text:

“DEFINITIONS

1. St. Lawrence River – the section of the St. Lawrence River that is affected by flow regulation, which stretches from Lake Ontario to the outlet of Lake St. Pierre.

2. International Rapids Section - the section of the St. Lawrence River that prior to the project was characterized by series of rapids from Ogdensburg, NY- Prescott, ON to Cornwall, ON – Massena, NY.
3. Pre-project conditions – the hydraulic channel characteristics that existed in the Galops Rapids Section of the St. Lawrence River as of March 1955 that formed the control section for Lake Ontario outflows prior to the project. This is defined by a stage-discharge capacity relationship for this condition that also accounts for the effects of glacial isostatic adjustment.

APPENDIX A to the October 29, 1952, Order is amended by the deletion of the text "with provision for ice handling and discharge sluices." under (c) Power House Structures under FEATURES OF THE WORKS APPROVED BY THIS ORDER.

Signed this ___ day of _____ 2016

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Gordon W. Walker

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Lana B. Pollack

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Benoit Bouchard

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Richard M. Moy

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Richard A. Morgan

[SIGNED DOCUMENT TO FOLLOW]

International Joint Commission

International Lake Ontario - St. Lawrence River Board

Directive

This directive updates and replaces the November 16, 1953 directive that created the International St. Lawrence River Board of Control. This directive creates and directs the International Lake Ontario-St. Lawrence River Board as a new Board, with any further direction to the new Board to be issued by the International Joint Commission (the Commission) from this date forward.

Function and Composition of the Board

The International Lake Ontario-St. Lawrence River Board (Board) is responsible for ensuring compliance with the Order of Approval pertaining to the regulation of flows and levels of the St. Lawrence River and Lake Ontario, the regulation plan approved by the Commission and any requirements or duties outlined in directives from the Commission.

The Board shall perform duties specifically assigned to it in the Order of Approval as well as those assigned to it by the Commission directives. Under the Order, the Board has duties related to flow regulation and responsibilities related to adaptive management, communications and public involvement. To carry out these duties, the Board shall meet at least twice a year, hold teleconferences as needed, and provide semi-annual reports to the Commission. It will also follow the Commission's public affairs policy including requirements for regularly meeting with the public.

The Board shall have an equal number of members from each country. The Commission shall determine the number of members (normally a minimum of 10) and shall normally appoint each member for a three-year term. Members may serve for more than one term. Members shall act in their personal and professional capacity, and not as representatives of their countries, agencies or institutions. They are to seek decisions by consensus according to the tradition of the Commission.

Within this binational balance, at least one Board member will be from each of the five jurisdictions – federal, provincial and state. The jurisdictions may nominate members to serve on the Board. The Commission will review nominees, in consultation with the respective nominating federal, state or provincial jurisdiction, to ensure that all Board members are suited to fulfilling the new and continuing responsibilities of the Board. The expertise of potential Board members, their ability to act impartially and effectively with good judgment, their commitment

to work towards Board consensus, engage appropriately with the public and reach decisions quickly when necessary will be key considerations for the Commission in the appointment of candidates to the Board. The Commission will appoint the nominees if it finds them suitable. If the Commission determines a nominee is not suitable, it will request the nominating jurisdiction to make an additional nomination (or nominations) until the Commission determines the nominee is suitable. In addition to members nominated by the jurisdictions, the Commission itself may appoint members to obtain an appropriate balance of expertise and geographic representation on the Board. The Commission shall appoint one member from each country to serve as co-chairs of the Board. Each co-chair is to appoint a Secretary, who, under the general supervision of the chair(s), shall carry out such duties as are assigned by the chairs or the Board as a whole. Upon request to the Commission, either co-chair may appoint an alternate member to act as Chair when they are not available to the Board.

The co-chairs of the Board, through the assistance of the Board secretaries, shall be responsible for maintaining proper liaison between the Board and the Commission, among the Board members and between the Board and its sub-groups. Chairs shall ensure that all members of the Board are informed of all instructions, inquiries, and authorizations received from the Commission and also of activities undertaken by or on behalf of the Board, progress made, and any developments affecting such progress.

In order to provide prompt action which may be necessary under winter operations or emergency conditions, each of the co-chairs of the Board shall appoint a Regulation Representative who is authorized by the Board to act on its behalf in such situations. Among other duties, the Regulation Representatives shall maintain a database of hydrological information for the Board, conduct the regulation plan calculations, make needed within-the-week flow adjustments, coordinate and keep account of flow deviations, and advise the Board on regulation operations.

The Board shall appoint an Operations Advisory Group (OAG) composed of representatives from the operating entities and shall keep the Commission informed of OAG membership. The Board and the Regulation Representatives may consult with OAG members individually or collectively as the occasion requires.

Flow Regulation

The Board shall set flows from Lake Ontario into the St. Lawrence River through the Moses-Saunders Dam and Long Sault Dam in accordance with the Order of Approval, normally as specified by the approved weekly flow regulation plan and directives from the Commission. It shall also approve the gate setting at the Iroquois Dam in consideration of Lake St. Lawrence levels and ice management, which may be delegated to the Regulation Representatives for prompt action.

The Board shall oversee the normal flow variations carried out by the hydropower entities according to the directive on peaking and ponding issued by the Commission. The Board shall also supervise the Regulation Representatives in their conduct of within-the-week flow adjustments and shall direct minor and major flow deviations when required, consistent with the Commission's directive and Order of Approval.

Following the regulation plan will be important over the long-term to ensure that the expected objectives for system regulation are achieved.

Adaptive Management

The Board will take part in an adaptive management strategy designed to verify that the effects of the new regulation plan over time are as anticipated, react to the influence of changing conditions such as climate change, and adapt or improve the implementation of the regulation plan as required. The Board may also use the information acquired through the adaptive management strategy to propose to the Commission modifications to the plan should it learn over time that conditions (climatic, socio-economic or environmental) have changed enough such that the plan is no longer meeting its intended objectives or improvements to the plan could realize increased benefits.

Communications and Public Involvement

The Board is directed to have a communications committee. The aim of the communications committee is to ensure that everyone interested in the regulation of the Lake Ontario-St. Lawrence River system is informed and has opportunities to express personal views regarding regulation. The communications committee will ensure that the Board is proactive in acquiring knowledge about stakeholder needs and perspectives on an ongoing basis and in providing them with regular information about Board decisions and the issues before the Board. The Commission encourages the Board to take advantage of multiple means, including modern technology and alternative communications fora, to better inform and receive input from stakeholders and the public within the framework of the Commission's communication strategy. The Board may collaborate with other Commission boards, governmental and quasi-governmental organizations to effectively strengthen information delivery and involve the public.

The Commission (through its public information officers) shall be informed, in advance, of plans for any public meetings or public involvement in the Board deliberations. The Board shall report in a timely manner to the Commission on these meetings, including representations made to the Board.

The Board shall provide the text of media releases and other public information materials to the Secretaries of the Commission for review by the Commission's Public Information Officers, prior to their release in English and French.

Reports, including semi-annual reports, and correspondence of the Board shall normally remain privileged and be available only to the Commission and to members of the Board and its committees (including appropriate individuals who support these entities with respect to Lake Ontario-St. Lawrence River activities) until their release has been authorized by the Commission. Board members and committees shall maintain files in accordance with the Commission policy on segregation of documents. All Board members shall be provided with these policy documents at the time of their appointment to the Board.

The Board shall provide minutes of Board meetings to the Commission within 45 days of the close of the meeting in keeping with the Commission's April 2002 Policy Concerning Public Access to Minutes of Meetings. The minutes will subsequently be put on the Commission's website.

To facilitate communication between the Board and the relevant federal, state and provincial jurisdictions of the Lake Ontario–St. Lawrence River system, the Commission shall request from these jurisdictions the name of an appropriate contact person and provide these names to the Board. The Board should note that its communications with the jurisdictions are only with respect to the carrying out of the functions of the Board, as set out in the Order of Approval and associated directives. It will remain the role of the Commission to engage all the jurisdictions (federal, state, provincial), as appropriate in the consideration of any changes to the regulation plan or directives to the Board. Any issues raised by the jurisdictions with the Board in these respects should be redirected to the Commission.

Other Aspects

According to need and on an ad-hoc basis, the Board may establish any other committees and working groups as may be required to discharge its responsibilities effectively. The Commission shall be kept informed of the duties and composition of any committee or working group. Commissioners and relevant Commission staff are invited to any meetings of the Board and any committees the Board may establish. Unless other arrangements are made, members of the Board, committees, or working groups will make their own arrangements for reimbursement of necessary expenditures. The Commission should also be informed of the Board's plans and progress and of any developments or cost impediments, actual or anticipated, that are likely to affect carrying out the Board's responsibilities.

If, in the opinion of the Board or of any member, any instruction, directive, or authorization received from the Commission lacks clarity or precision, then the matter shall be referred

promptly to the Commission for appropriate action. In the event of any unresolved disagreement among the members of the Board, the Board shall refer the matter forthwith to the Commission for decision.

Signed this xxth day of December 2016.

Secretary
Canadian Section

Secretary
United States Section

[SIGNED DOCUMENT TO FOLLOW]

International Joint Commission

Directive to the International Lake Ontario - St. Lawrence River Board on Operational Adjustments, Deviations and Extreme Conditions

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This directive was created in conjunction with the proposed revised Order of Approval. It provides specific protocols and guidance to the International Lake Ontario-St. Lawrence River Board for implementing a regulation plan approved by the Commission, particularly as they relate to making operational adjustments, deviating from that plan, and managing extreme conditions. This directive updates and replaces all past directives on these topics to the former International St. Lawrence River Board of Control, including letters from the International Joint Commission (the Commission) dated May 5, 1961 and October 18, 1963 that vested the Board with limited authority to deviate from the approved regulation plan.

Plan 2014 is the combination of the mechanistic release rules labeled "Bv7" (described in Annex B of the June 2014 report on Plan 2014) together with discretionary decisions made by the International Lake Ontario - St. Lawrence River Board to deviate from the flows specified by the rules of Bv7 according to this directive on deviations. In that regard, Bv7 is analogous to Plan 1958-D; each is a set of release rules (algorithms) that produce an unambiguous release amount each week.

Under the 2016 Supplementary Order of Approval, the International Lake Ontario – St. Lawrence River Board is responsible for ensuring compliance with the Order pertaining to the regulation of the St. Lawrence River and Lake Ontario and any requirements outlined in directives from the Commission. This includes setting weekly discharges for the St. Lawrence River through the flow control structures of the Moses-Saunders hydro-electric plant located at Cornwall-Massena according to the regulation plan approved by the Commission. Bv7 release rules are designed to handle a broader range of water supply situations than the previous release rules (Plan 1958-D). In most instances, it will be important to release flows as determined by the release rules in order to realize its expected benefits. Therefore, the Commission anticipates fewer, more limited instances where flow releases would differ from those of the release rules than was the case with 1958-D.

The following sections of this directive describe and differentiate between operational adjustments, minor, major, and emergency deviations. This directive also explains when and how the Board can adjust and deviate from the outflows prescribed by the regulation plan. If the Board cannot establish consensus regarding deviations from plan outflows, then the issue shall be raised immediately to the Commission through the Commission's Engineering Advisors located in Washington, DC and Ottawa, ON. In such cases, the Board must reach consensus on an interim outflow in consideration of the

particular circumstances at the time and that is consistent with the Treaty, while the Commission makes a decision.

Operational Adjustments due to Inaccurate Forecasts

The rules and logic of the regulation plan determine the flow to be released for the coming week based on observed and forecasted hydrologic and ice conditions. As forecasts of conditions have some uncertainty, there will be occasions when the actual within-the-week conditions experienced differ significantly from the forecasted conditions used to calculate the regulation plan flow. Due to inaccurate forecasts, in some cases adjustments to the flows determined by the regulation plan at the beginning of the regulation week will be required later in the week in order to maintain the intent of the plan. The Board will consider these flow adjustments as within-plan operations and not as deviations from the plan.

The rules and logic of the plan provide protection against extreme high and low levels downstream in balance with Lake Ontario levels. The Board shall oversee operational adjustments to successfully manage rapidly varying flood and low flows coming from the Ottawa River in accordance with the rules set out in the regulation plan, unless conditions require minor or major deviations as defined below. The plan also includes rules, based on decades of operational experience, to form and manage the ice cover in the river reaches of importance upstream of the Moses-Saunders and Beauharnois hydro-electric plants. The Board shall also continue flow changes as needed for ice management in these river reaches consistent with the intent of the plan. Ottawa River discharges and St. Lawrence River ice conditions can change significantly from day-to-day, and the week-ahead forecasts of Ottawa River flows and St. Lawrence River ice conditions used for regulation calculations are subject to rapid variations due to changing weather conditions. Therefore, short-term within-the-week flow adjustments will be made when needed to avoid flooding near Montreal consistent with the intent of the plan when the Ottawa River flow is very high and changing rapidly. Such adjustments will also be made when required to maintain St. Lawrence River levels above the minimums specified in the plan when inflows to the river are varying. As ice conditions can vary quickly due to changing weather conditions, it is anticipated that adjustments will also be necessary for the formation of a smooth ice cover to prevent ice jams in the International Rapids Section of the St. Lawrence River and the Beauharnois Canal. Within-the-week flow adjustments may also be required to address other unexpected within-the-week changes in river conditions. These flow adjustments are consistent with and accounted for in the design of the regulation plan, which was developed with the assumption that the flows during the Ottawa River freshet, droughts and the ice formation would be adjusted in practice within the week as they have been with Plan 1958DD. Therefore, no future offsetting adjustments are needed to compensate for within-the-week flow adjustments due to uncertainties in forecasts of Ottawa River flows, St. Lawrence River ice conditions, or other weather-related circumstances that are made to maintain the intent of the Plan.

The Board may direct its Regulation Representatives to be responsible for monitoring conditions, making operational flow adjustments and tracking their use. Tracking records will be used to replicate plan results, as needed for subsequent plan reviews.

Minor Deviations for the St. Lawrence River

To respond to short-term needs on the St. Lawrence River, the Commission will allow the Board to make minor discretionary deviations from the approved regulation plan that have no appreciable effect on Lake Ontario levels. Minor deviations are made to provide beneficial effects or relief from adverse effects to an interest, when this can be done without appreciable adverse effects to other interests and is consistent with the requirements of the Order of Approval. Unlike flow adjustments made to maintain the intent of the plan, minor deviations from the plan require accounting and flow restoration.

Minor deviations, while not necessarily limited to only these situations, could include those to address contingencies such as:

- short-term flow capacity limitations due to hydropower unit maintenance;
- assistance to commercial vessels on the river due to unanticipated low water levels;
- assistance, when appropriate, with recreational boat haul-out on Lake St. Lawrence or Lake St. Louis at the beginning or at the end of the boating season; and,
- unexpected ice problems on the St. Lawrence River downstream of Montreal.

These deviations will affect levels on Lake St. Lawrence and the St. Lawrence River downstream to Montreal, but due to the relatively small volume of water involved, such deviations would have a very minor effect on Lake Ontario levels and the river upstream of Cardinal, ON. The intention is for minor flow deviations to be restored by equivalent offsetting deviations from the plan flow as soon as conditions permit to avoid or minimize cumulative impacts on the Lake Ontario level and avoid changing the balance of benefits under the approved regulation plan. Some discretion will be left to the Board as to whether conditions permit the restoration of the volume of water released or held back by these deviations. However, the Board shall not allow the cumulative effect of these minor deviations to cause the Lake Ontario level to vary by more than +/- 2 cm from that which would have occurred had the releases prescribed by the approved plan been strictly followed. The intent is to accommodate, where possible, those needs of the river interests that are difficult to foresee and build into the plan, while being consistent with the intent of the regulation plan and Order of Approval.

The Board will provide post-action reports to the Commission of these minor deviations from plan flows as part of normal semi-annual reporting requirements. However, if circumstances are such that minor deviations cause the Lake Ontario level to vary more than +/- 2 cm from the level resulting from the approved plan (*i.e.*, potentially having a significant impact on Lake Ontario levels), then the Board shall advise the Commission in advance as soon as the potential need for the longer-term deviation is known. If there is a need for a longer-term deviation, the Board must provide a flow restoration plan and obtain approval from the Commission, or obtain a waiver from the Commission not requiring flow

restoration. It is intended that such a waiver be rarely used so as to avoid changing the balance of benefits associated with the approved regulation plan.

The Board may direct its Regulation Representatives to approve minor deviations from plan flow, within parameters set by the Board.

Major Deviations

Major deviations are significant departures from the approved regulation plan that are made in response to extreme high or low levels of Lake Ontario in accordance with criterion H14 of the revised Order of Approval:

> *In the event that Lake Ontario water levels reach or exceed extremely high levels, the works in the International Rapids Section shall be operated to provide all possible relief to the riparian owners upstream and downstream. In the event that Lake Ontario levels reach or fall below extremely low levels, the works in the International Rapids Section shall be operated to provide all possible relief to municipal water intakes, navigation and power purposes, upstream and downstream. The high and low water levels at which this provision applies, and any revisions to these levels, shall be subject to the concurrence of Canada and the United States and shall be set out in a Commission directive to the Board.*

Major deviations are expected to significantly alter the level of Lake Ontario compared to the level that would occur by following the approved regulation plan. Although the approved regulation plan was developed to perform under a wide range of hydrological conditions and with the experience gained in four decades of regulation operations, extreme high or low Lake Ontario water levels could require major deviations from the plan. Extreme high and low Lake Ontario levels to trigger major deviations are set out in Table 1 of this directive based on quarter-month levels through the year. If the Board expects that lake levels will be outside the range defined by the trigger levels, then based on analysis using the technical expertise at its disposal, the Board will inform the Commission that it expects to make a major deviation from the plan once the trigger level is reached to moderate the extreme levels. The Board is authorized to use its discretion to set flows in such conditions and deviate from the approved plan to provide balanced relief to the degree possible, upstream and downstream, in accordance with criterion H14 and the Treaty. For example, if the lake level is above the high trigger, then the Board could decide to increase the flow to the maximum specified by the limits used in the approved regulation plan if the plan flow is not already at this maximum, or it could apply the maximum flow limits used in Plan 1958DD, or it could release another flow consistent with criterion H14. While major deviations take downstream interests into account, they are not triggered by downstream levels, as the Bv7 release rules are designed to prevent extreme levels downstream, provided that Lake Ontario levels are not at extremes.

The Commission emphasizes that for the objectives of the approved regulation plan to be met, the regulation plan needs to be followed until water levels reach any of the defined triggers. The Board shall keep the Commission informed of the difference between the Lake Ontario level and the defined trigger levels. The Board will provide regular reports on implementation of the major deviation to the Commission. As the extreme event ends, the Board shall develop for Commission approval a strategy to return to plan flows and recommendations as to whether or not equivalent offsetting deviations from the plan flow should be made, as appropriate on a case-by-case basis.

The effectiveness of major deviations initiated with the trigger levels defined in Table 1**Error! Reference source not found.** will be assessed as part of the adaptive management process through follow-up monitoring and modeling. The trigger levels or implementation of major deviations could be modified by the Commission through future directives if warranted.

Emergency Deviations

Emergency situations are considered to be those that threaten the physical integrity of the water management system and that may lead to a loss of the ability to control the flows in the system, or unusual life-threatening situations. Examples could include the failure of a lock gate, flooding of the hydropower control works, failure of a spillway gate, dike failure, a regional power outage, or other such active or imminent incidents. Such incidents arise only on extremely rare occasions. In such cases, immediate action is required and the Board is directed to authorize the Regulation Representatives to direct and approve, on the Board's behalf, emergency flow changes as required. The Regulation Representatives will report any such emergency actions as soon as possible to the Board and immediately thereafter the Board will report such actions to the Commission.

The Board will determine the need to make subsequent equivalent offsetting deviations from the plan flow, as appropriate, on a case-by-case basis.

Signed this xxth day of December 2016.

Secretary
Canadian Section

Secretary
United States Section

TABLE 1 Lake Ontario quarter-monthly high and low water levels to trigger operations according to criterion H14.

Quarter-month of the year		Lake Ontario level (metres IGLD85)		Lake Ontario level (feet IGLD85)*	
		High Trigger	Low Trigger	High Trigger	Low Trigger
1	1-Jan	75.03	74.28	246.16	243.70
2		75.07	74.28	246.29	243.70
3		75.10	74.28	246.39	243.70
4		75.13	74.27	246.49	243.67
5	1-Feb	75.14	74.27	246.52	243.67
6		75.14	74.26	246.52	243.64
7		75.13	74.26	246.49	243.64
8		75.14	74.26	246.52	243.64
9	1-Mar	75.16	74.28	246.59	243.70
10		75.18	74.31	246.65	243.80
11		75.22	74.34	246.78	243.90
12		75.27	74.40	246.95	244.09
13	1-Apr	75.33	74.48	247.15	244.36
14		75.40	74.54	247.38	244.55
15		75.45	74.59	247.54	244.72
16		75.50	74.64	247.70	244.88
17	1-May	75.53	74.67	247.80	244.98
18		75.56	74.69	247.90	245.05
19		75.60	74.72	248.03	245.14
20		75.62	74.74	248.10	245.21
21	1-Jun	75.63	74.75	248.13	245.24
22		75.62	74.75	248.10	245.24
23		75.60	74.76	248.03	245.28
24		75.59	74.76	248.00	245.28
25	1-Jul	75.57	74.75	247.93	245.24
26		75.54	74.75	247.83	245.24
27		75.50	74.74	247.70	245.21
28		75.47	74.72	247.60	245.14
29	1-Aug	75.43	74.70	247.47	245.08
30		75.39	74.68	247.34	245.01
31		75.34	74.65	247.18	244.91
32		75.30	74.62	247.05	244.82
33	1-Sep	75.26	74.59	246.92	244.72
34		75.20	74.56	246.72	244.62
35		75.15	74.53	246.56	244.52
36		75.10	74.50	246.39	244.42
37	1-Oct	75.06	74.47	246.26	244.32
38		75.01	74.44	246.10	244.23
39		74.97	74.41	245.96	244.13
40		74.95	74.39	245.90	244.06
41	1-Nov	74.94	74.36	245.87	243.96
42		74.92	74.35	245.80	243.93
43		74.91	74.33	245.77	243.86
44		74.92	74.32	245.80	243.83
45	1-Dec	74.93	74.31	245.83	243.80
46		74.93	74.31	245.83	243.80
47		74.95	74.29	245.90	243.73
48		75.00	74.28	246.06	243.70

* As regulation operations are conducted in metres, approximate conversions to feet are listed for convenience.

Annex B

Lake Ontario – St. Lawrence Plan 2014

Lake Ontario - St. Lawrence Plan 2014 is the combination of the mechanistic release rules labeled "Bv7" together with discretionary decisions made by the International Lake Ontario - St. Lawrence River Board to deviate from the flows specified by the release rules Bv7 according to the Directive on Operational Adjustments, Deviations and Extreme Conditions. In that regard, Bv7 is analogous to Plan 1958-D. Each is a set of functions that can be programmed to produce a release based on established categories of input conditions such as current water levels. The following is a technical description of the Bv7 algorithm or release rules.

B1. Technical Description of Plan Bv7 Release Rules

B1.1 Objectives

The objective of the Bv7 release rules is to return the Lake Ontario-St. Lawrence River System to a more natural hydrological regime, while limiting impacts to other interests. Bv7 rules build on the B+ rules developed during the International Lake Ontario - St. Lawrence River Study. Bv7 differs from B+ in that it includes additional rules to maintain navigation and flood reduction benefits on the lower St. Lawrence River (Lake St. Louis to Lake St. Pierre) and adjustments to the B+ rules to balance Lake Ontario and lower river levels. Bv7 maintains most of the benefits of the current regulation regime because the range of levels and flows that Bv7 produces are closer to the current regulation regime than to unregulated conditions.

B1.2 Goals

The goals of the rules are to:

- Maintain more natural seasonal level and flow hydrographs on the lake and river;
- Provide stable lak e releases;
- Maintain benefits to coastal interests as much as possible while enhancing environmental conditions;
- Maintain benefits to recreational boating as much as possible while enhancing environmental conditions;
- Obtain inter-annual highs and lows required for healthy vegetation habitats;
- Enhance diversity, productivity, and sustainability of species sensitive to water level fluctuations;
- Provide flood and low water protection to the lower St. Lawrence River comparable to Plan 1958-D with Deviations; and,
- Maintain benefits as much as possible for municipal water intakes, commercial navigation and hydropower interests while taking other interests into account.

Bv7 uses short-term forecasts and a longer-term index of water supplies in conjunction with the pre-project stage-discharge relationship to determine lake releases. Rules are included to reduce the risk of flooding on the lake and river. Flow limits are applied to prevent river flows from falling too low, facilitate stable river ice formation, provide acceptable navigation conditions, provide safe operating conditions for control structures, and ensure controlled week-to-week changes in flows.

B2. Approach

B2.1 Rule Curves

Lake releases are primarily a function of a sliding rule curve based on the pre-project stage-discharge relationship adjusted to recent long-term supply conditions. The open-water pre-project stage-discharge relationship, in units of cubic meters per second (m^3/s) is:

$$\text{Pre-project release} = 555.823(\text{Lake Ontario level} - 0.035\text{-}69.474)^{1.5}$$

In the equation above, the 0.035 meter term adjusts the Lake Ontario level (referenced to IGLD 1985)

for differential crustal movement fixed to the year 2010[26]. The pre-project relationship is that from Caldwell and Fay (2002), but here the ice retardation effect is not considered.

The flow computed with this equation is then adjusted depending on the recent supply conditions. As water supplies trend above normal, lake releases are increased. As supplies trend below normal, lake releases are decreased.

For supplies above normal (the index is greater than or equal to 7,011 m^3/s), the lake release is determined by:

Table B1.
Bv7 Rule Curve Parameter Values based on Historical Supplies

Climate	A_NTS_{max}	A_NTS_{avg}	A_NTS_{min}
Historical (1900-2000)	8552 m^3/s	7011 m^3/s	5717 m^3/s

The rule curve parameters should be updated periodically to account for climate change.

$$outflow_t = preproject\ release + \left[\frac{F\_NTS - A\_NTS_{avg}}{A\_NTS_{max} - A\_NTS_{avg}}\right]^{P_1} x(C_1)$$

For supplies below normal (the index is less than 7,011 m^3/s), the lake release is determined by:

$$outflow_t = preproject\ release - \left[\frac{A\_NTS_{avg} - F\_NTS}{A\_NTS_{avg} - A\_NTS_{min}}\right]^{P_2} x(C_2)$$

In the equation above, ***F_NTS*** is a supply index based on the net total supply for the past 52 weeks (48 quarter-months), and ***A_NTS*** represents the maximum, minimum and average statistics of the annual net total supply series. The constants C_1 and C_2 determine the rate of flow adjustment to the pre-project release. C_1 is further dependent on the long-term trend in supplies. If the categorical long-term trend indicator is 1 (demonstrating above normal supplies; that is, when the current supply value exceeds 7,237 m^3/s) and the confidence indicator is 3 (indicating high confidence in extreme supplies; that is, when the current supply value exceeds 7,426 m3/s), then C_1 is set to 2,600 m^3/s, otherwise it is equal to 2,200 m^3/s. The value of C_2 is 600 m^3/s. The exponents P1 and P2 serve to accelerate or decelerate the rate of flow adjustment. The values of P_1 and P_2 are 0.9 and 1.0, respectively.

The flow is further reduced by 200 m3/s if the 52 week (48 quarter-month) running lake level mean is less than or equal to 74.6 m IGLD 1985.

Variability of releases from one week (or quarter-month) to the next is smoothed by taking the average of short-term forecasts[27] of releases four weeks (or quarter-months) into the future:

$$outflow = \frac{\sum_{t=1}^{t=4} outflow_t}{4}$$

This averaging also has the impact of accelerating releases during periods of rising lake levels (typically spring), and decelerating releases during periods of falling lake levels (typically fall). Sensitivity analysis indicated that forecasts four quarter-months into the future were optimal.

Bv7 also has a rule to reduce the risk of Lake Ontario and St. Lawrence River flooding in the following spring and summer. If the level of Lake Ontario is relatively high, then it adds to the rule curve flow to reduce the level of Lake Ontario in the fall. It lowers otherwise high Lake Ontario by the onset of winter, thus preparing for spring and making temporary lake storage available for reduced flows during the Ottawa River freshet. It also provides

[26] The year 2010 was selected by the ILOSLRS Plan Formulation and Evaluation Group to compare what pre-project conditions would be near the completion of the Study. The year should be fixed as otherwise there would be a gradual increase in the lake level due to the continual adjustment for glacial isostatic uplift of the lake's outlet.

[27] See Lee (2004) for the derivation of the forecast algorithms

some benefit (relative to the Natural Plan) to the lower river muskrats by reducing winter den flooding. The rule strives to lower Lake Ontario to 74.8 m by January 1 whenever Lake Ontario level is above 74.8 m at the beginning of September. The rule curve flow is linearly increased by the amount needed to eliminate the storage on the lake above 74.8 m over the remaining time before January 1. A check is made to ensure that the adjusted flow for the first week of September does not exceed that of the last week in August to prevent falling levels affecting Lake St. Lawrence recreational boaters through the Labor Day weekend. The adjusted flow is constrained by the L Limits.

B2.2 Flow Limits

Several flow limits, adapted from previous plan development, are used in Bv7. If the rule curve flow (described above) falls outside of these limits, then the lowest of the maxima, or the minimum limit, as applicable, constrains the rule curve flow.

- J Limit – maximum change in flow from one week (or quarter-month) to the next unless another limit takes precedence. Flows are permitted to increase or decrease by up to 700 m^3/s. If the lake is above 75.2 m, and ice is not forming, then the flow may increase by up to 1,420 m^3/s from one week (or quarter-month) to the next.
- M Limit – minimum limit flows t o balance low levels of Lake Ontario and Lake St. Louis primarily for Seaway navigation interests. This limit uses a one week (or quarter-month) forecast of Ottawa River and local tributary flows to estimate the inflows to Lake St. Louis, other than those from Lake Ontario. In actual operation, the flow will be adjusted from day-to-day to maintain the level of Lake St. Louis above the applicable level determined by the Lake Ontario stage.
- I Limit – maximum flows for ice formation and stability.[28] During ice cover formation, either downstream on the Beauharnois Canal or on the critical portions of the International Section, the maximum flow is 6,230 m^3/s. Once a complete ice cover has formed on the key sections of the river, the winter flow constraint prevents the river level at Long Sault from falling lower than 71.8 m. (Note the J limit also applies.) This limit may apply in the non-Seaway season whether ice is present or not. This flow limit is calculated using the stage-fall discharge equation for Kingston-Long Sault, which includes an ice roughness parameter that must be forecast for the coming period. This limit prevents low levels that might impact municipal water intakes on Lake St. Lawrence, and also acts to limit the shear stress on the ice cover and maintain stability of the ice cover. The I limit also limits the maximum flow with an ice cover present in the Beauharnois and/or international channels to no more than 9,430 m^3/s.
- L Limit – maximum flows to maintain adequate levels and safe velocities for navigation in the International Section of the river (navigation season) and the overall maximum flow limit (non-navigation season). Maximum releases are limited to 10,700 m^3/s if the Lake Ontario level should rise above 76.0 m during the navigation season and 11,500 m^3/s during the non-navigation season.

[28] Managing flows during ice formation on the Beauharnois Canal and upstream is paramount, since a restriction caused by a build-up of rough ice in the Beauharnois Canal or upper river can constrain outflows the remainder of the winter which may, in some cases, exacerbate high Lake Ontario levels. During ice formation, operation of the Iroquois Dam must be done in consideration of ice conditions on Lake St. Lawrence.

Table B2.
M Limits as used in Plan Bv7.

Lake Ontario level (m, IGLD 1985)	Total Flow from Lake St. Louis (m^3/s)	Approximate Corresponding Lake St. Louis level at Pointe Claire (m IGLD 1985)
> 74.2	6,800	20.64
> 74.1 and ≤ 74.2	6,500	20.54
> 74.0 and ≤ 74.1	6,200	20.43
> 73.6 and ≤ 74.0	6,100	20.39
≤ 73.6	Minimum of 5,770 or pre-project flow	20.27 or less

Table B3.
L Limits as used in Plan Bv7.

Lake Ontario level (m, IGLD 1985)	L Limit Flow (m^3/s)
For Seaway navigation season (i.e. quarter-months 13-47):	
≤ 74.22	5,950
> 74.22 and ≤ 74.34	5,950+1,333 (Lake Ontario level – 74.22)
> 74.34 and ≤ 74.54	6,111+9,100 (Lake Ontario level – 74.34)
> 74.54 and ≤ 74.70	7,930+2,625 (Lake Ontario level – 74.54)
> 74.70 and ≤ 75.13	8,350+1,000 (Lake Ontario level – 74.70)
> 75.13 and ≤ 75.44	8,780+3,645 (Lake Ontario level – 75.13)
> 75.44 and ≤ 75.70	9,910
> 75.70 and ≤ 76.00	10,200
> 76.00	10,700
For outside Seaway season (i.e. quarter-months 48-12) all levels	
Any	11,500

Table B4.
Lake St. Louis (Pointe Claire) levels corresponding to Lake Ontario levels for limiting lower St. Lawrence River flooding damages (F limits).

Lake Ontario level (m, IGLD 1985)	Pte. Claire level (m, IGLD 1985)
< 75.3	22.10
≥ 75.3 and < 75.37	22.20
≥ 75.37 and < 75.5	22.33
≥ 75.5 and < 75.6	22.40
≥ 75.6	22.48

An additional rule limits the maximum flow in the Seaway season to prevent the weekly mean level of Lake St. Lawrence at Long Sault Dam from falling below 72.60 m. To deal with very low levels, if the Lake Ontario level is below chart datum (74.20 m) then the level of Lake St. Lawrence at Long Sault Dam in this rule is allowed to be equally below the 72.60 m level.

A final check ensures that the L Limit does not exceed the actual channel hydraulic capacity (in m^3/s) defined as (Lee *et al.*, 1994):

$$\text{channel capacity} = 747.2(\text{Lake Ontario level} - 69.10)^{1.47}$$

- F limit – the maximum flow to limit flooding on Lake St. Louis and near Montreal in consideration of Lake Ontario level. It is a multi-tier rule that attempts to balance upstream and downstream flooding damages by keeping the level of Lake St. Louis below a given stage for a corresponding Lake Ontario level as follows:

This limit uses a one week (or quarter-month) forecast of the Ottawa River and local tributary inflows and the following relationship between Lake St. Louis outflows and levels at Pointe Claire:

$$Pte.\ Claire\ level = 16.57 + \left[\left(R_{Pt.Claire} \times Q_{L.St.Louis} / 604.0\right)^{0.58}\right]$$

In this equation, ***R*** is the roughness factor and ***Q*** (in m^3/s) is the total flow from Lake St. Louis. In operation the flow will be adjusted from day to day to maintain the level of Lake St. Louis below the applicable level determined by the Lake Ontario stage.

B3. Application

Bv7 uses imperfect forecasts of Lake Ontario total supplies, Ottawa River and local tributary flows, ice formation and ice roughness. The water supply forecasts are based on time-series analysis of the historical data as described in Lee (2004). Overall, the statistical forecasts were found to have similar error to those in use operationally. Because the operational methods generally rely upon hydrometeorological data not available for either the historical time series or the stochastic time series, actual forecasts could not be used. However, it was envisioned that operationally, the best available real-time forecasts would be used. In addition, because week-ahead forecasts will generally be imperfect, it is expected that in actual operations the flows will be adjusted within the week[29] taking into account the actual ice and downstream inflow conditions to achieve the intent of the Bv7 rules and limits.

B3.1 Procedure

1. For each of the next four weeks (quarter-months), calculate the Lake Ontario annual net total supply index, forecast the weekly (quarter-monthly) Lake Erie inflow and Lake Ontario net basin supply, Ottawa River and local tributary flows to Lake St. Louis, and ice roughness.
2. For each of the next four weeks (quarter-months), sequentially route the supplies and determine forecasts of lake outflows using the sliding rule curve.
3. Average the next four weeks (quarter-months) forecast releases to determine the next period's release.
4. If the current time period is within September through December inclusive, and Lake Ontario was at or above 74.8 m on September 1 (end of quarter-month 32), then increase the basic rule curve by the amount needed to achieve 74.8 m by January 1, not exceeding the flow in the week before Labor Day (quarter-month 32) in the flow in the Labor Day week (quarter-month 33).
5. Apply the M, L, I, J and F limits. If the plan flow is outside of the maximum of the minimum limits and the minimum of the maximum limits, the appropriate limit becomes the plan flow.

B4. Simulation of Bv7 with 1900-2008 Hydrology and Ice Conditions

The tables on the following pages are based only on the Bv7 release rules, not the deviations in Plan 2014. The tables show how often under Bv7 water levels will be above a range of levels for Lake Ontario, Lake St. Lawrence, Lake Louis and Montreal Harbour, and how often releases from the Moses-Saunders dam will be above certain flows. The tables are based on a simulation of Bv7 on a quarter-monthly time step and with the 1900-2008 dataset of supplies and inflows, ice conditions, channel roughness factors,

[29] See **Annex C** for more on operational adjustments

and related conditions. This 109-year simulation includes 436 quarter-months for each calendar month, 5,232 quarter-months in all. For example, in Table B-5, Lake Ontario never rises above 75.80 meters, but rises above 75.70 meters six times in May and three times in June.

The tables are:

- Table B 5 Bv7 Historical Lake Ontario Levels
- Table B 6 Bv7 Historical Lake Ontario Outflows
- Table B 7 Bv7 Historical Lake St Lawrence at Long Sault Dam Levels
- Table B 8 Bv7 Historical Lake St. Louis Levels
- Table B 9 Bv7 Historical Montreal Harbour at Jetty 1 Levels

Table B5.

Bv7 Historical Lake Ontario Levels

Lake Ontario Quarter-monthly mean levels Number of Occurences Above Level Shown ... 1900-2008 supplies simulation													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**All Months**
Level (m IGLD 1985)													
75.8	0	0	0	0	0	0	0	0	0	0	0	0	0
75.7	0	0	0	0	6	3	0	0	0	0	0	0	9
75.6	0	0	0	6	10	12	6	0	0	0	0	0	34
75.5	0	0	0	12	23	27	13	2	0	0	0	0	77
75.4	0	0	1	24	43	52	30	9	0	0	0	0	159
75.3	2	6	3	39	90	91	61	18	1	0	0	0	311
75.2	12	15	19	70	143	146	107	46	6	4	1	4	573
75.1	17	28	33	115	183	204	176	99	26	4	4	5	894
75.0	32	50	68	166	241	269	245	179	69	11	4	7	1341
74.9	63	79	115	216	296	322	312	251	136	34	17	23	1864
74.8	121	138	166	274	340	357	357	312	230	116	66	76	2553
74.7	163	185	226	339	381	397	389	368	306	230	143	135	3262
74.6	209	223	266	371	410	420	412	402	361	310	257	215	3856
74.5	306	295	335	397	418	420	419	410	394	351	321	312	4378
74.4	360	366	379	410	426	428	426	417	410	392	363	364	4741
74.3	390	390	396	418	428	429	432	421	413	408	391	388	4904
74.2	407	405	401	425	434	436	435	427	418	412	411	408	5019
74.1	415	409	411	428	436	436	436	436	423	418	420	414	5082
74.0	420	419	420	434	436	436	436	436	434	424	421	422	5138
73.9	424	424	427	435	436	436	436	436	436	429	424	424	5167
73.8	424	425	432	436	436	436	436	436	436	434	428	424	5183
73.7	431	432	436	436	436	436	436	436	436	436	433	430	5214
73.6	432	435	436	436	436	436	436	436	436	436	436	432	5223
73.5	436	436	436	436	436	436	436	436	436	436	436	436	5232
Maximum Level	75.31	75.39	75.46	75.7	75.75	75.72	75.65	75.59	75.36	75.26	75.22	75.25	75.75
Minimum Level	73.55	73.56	73.72	73.84	74.16	74.24	74.2	74.12	73.96	73.76	73.61	73.55	73.55

Table B6.

Bv7 Historical Lake Ontario Outflows

Lake Ontario Quarter-monthly mean Outflows Number of Occurences Above Flow Shown ... 1900-2008 supplies simulation													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**All Months**
Flow (m^3/s)													
10400	0	0	0	0	0	0	0	0	0	0	0	0	0
10200	0	0	0	0	0	0	0	0	0	0	0	0	0
10000	0	0	0	0	4	1	0	0	0	0	0	0	5
9800	2	0	2	5	14	15	5	1	0	0	0	0	44
9600	2	0	2	8	18	21	10	1	0	0	0	0	62
9400	2	0	6	9	22	24	16	3	0	0	0	0	82
9200	2	1	10	9	27	26	21	6	0	2	0	0	104
9000	2	5	15	12	37	37	25	10	1	4	1	3	152
8800	2	5	19	18	40	53	33	15	8	4	2	4	203
8600	2	7	24	31	61	70	61	32	24	8	4	7	331
8400	2	10	34	42	75	93	80	52	45	20	20	27	500
8200	5	24	48	66	104	115	95	65	59	30	29	29	669
8000	11	36	61	92	123	137	114	86	79	49	46	42	876
7800	13	48	76	114	147	165	135	108	110	69	59	52	1096
7600	26	63	97	130	175	192	172	132	139	86	73	67	1352
7400	33	76	121	168	201	220	207	165	164	114	91	84	1644
7200	38	97	149	212	244	259	250	216	199	136	115	100	2015
7000	50	128	178	246	292	299	290	260	238	178	147	114	2420
6800	99	174	211	284	326	340	322	297	262	212	179	146	2852
6600	123	224	256	325	356	365	360	333	286	251	225	177	3281
6400	151	265	305	358	390	387	376	374	347	312	279	216	3760
6200	322	338	349	386	401	407	414	415	403	376	348	331	4490
6000	373	375	394	399	408	419	428	432	420	405	382	381	4816
5800	398	401	409	404	421	429	434	434	427	412	400	403	4972
5600	416	416	415	412	425	432	436	436	434	427	414	413	5076
5400	424	422	421	421	431	435	436	436	435	431	423	425	5140
5200	429	429	427	429	433	436	436	436	436	432	430	434	5187
5000	434	435	431	431	435	436	436	436	436	432	435	435	5212
4800	435	436	433	434	436	436	436	436	436	435	436	435	5224
4600	436	436	436	436	436	436	436	436	436	436	436	436	5232
Maximum Flow	9910	9290	9910	9910	10200	10200	9910	9880	9150	9220	9060	9180	10200
Minimum Flow	4620	4910	4650	4780	4870	5250	5640	5760	5290	4800	4980	4780	4620

Table B7.

Bv7 Historical Lake St. Lawrence at Long Sault Dam Levels

Lake St. Lawrence at Long Sault Dam Quarter-monthly mean levels Number of Occurences Above Level Shown ... 1900-2008 supplies simulation													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**All Months**
Level (m IGLD 1985)													
74.4	0	0	0	0	0	0	0	0	0	0	0	0	0
74.3	4	0	0	0	0	0	0	0	0	0	0	0	4
74.2	6	0	0	0	0	0	0	0	0	0	0	1	7
74.1	8	0	0	0	0	0	0	0	0	0	0	2	10
74.0	13	1	0	0	0	0	0	0	0	0	0	5	19
73.9	21	2	0	3	1	4	6	1	0	0	0	10	48
73.8	30	6	6	67	139	130	95	52	7	0	2	19	553
73.7	44	10	18	138	208	209	190	141	28	13	15	33	1047
73.6	60	11	46	212	277	280	255	210	94	82	57	63	1647
73.5	90	14	76	278	336	314	287	259	177	155	138	134	2258
73.4	114	20	110	323	373	353	318	300	223	211	203	195	2743
73.3	136	29	132	369	397	386	346	331	270	267	257	242	3162
73.2	156	41	156	392	418	409	382	351	314	301	292	285	3497
73.1	186	65	188	414	428	422	409	374	341	336	328	323	3814
73.0	208	88	216	431	431	432	423	399	368	362	359	350	4067
72.9	221	114	242	433	432	434	429	412	393	388	381	374	4253
72.8	241	152	264	434	433	436	433	427	415	404	400	391	4430
72.7	261	180	292	434	435	436	435	433	426	416	417	410	4575
72.6	275	212	312	436	436	436	436	436	436	435	428	425	4703
72.5	299	228	331	436	436	436	436	436	436	436	433	432	4775
72.4	320	257	349	436	436	436	436	436	436	436	435	434	4847
72.3	339	276	359	436	436	436	436	436	436	436	436	434	4896
72.2	351	291	373	436	436	436	436	436	436	436	436	436	4939
72.1	359	307	382	436	436	436	436	436	436	436	436	436	4972
72.0	370	323	392	436	436	436	436	436	436	436	436	436	5009
71.9	376	336	402	436	436	436	436	436	436	436	436	436	5038
71.8	401	380	424	436	436	436	436	436	436	436	436	436	5129
71.7	436	436	436	436	436	436	436	436	436	436	436	436	5232
Maximum Level	74.35	74.09	73.88	73.92	73.92	73.93	73.93	73.91	73.86	73.74	73.81	74.29	74.35
Minimum Level	71.74	71.71	71.72	72.66	72.66	72.84	72.69	72.66	72.63	72.6	72.39	72.22	71.71

Table B8.

Bv7 Historical Lake St. Louis Levels

Lake St. Louis at Pointe Claire Quarter-monthly mean levels Number of Occurences Above Level Shown ... 1900-2008 simulation													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**All Months**
Level (m IGLD 1985)													
22.5	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	0	0	0	3	4	2	0	0	0	0	0	0	9
22.3	0	0	0	10	17	6	0	0	0	0	0	0	33
22.2	0	0	0	14	26	11	0	0	0	0	0	0	51
22.1	1	4	5	27	45	15	0	0	0	0	0	0	97
22.0	3	8	15	80	85	26	2	0	0	0	0	2	221
21.9	7	14	25	107	101	45	7	0	0	1	4	5	316
21.8	13	20	39	131	123	58	19	4	0	1	6	10	424
21.7	23	35	57	162	155	77	30	8	1	3	10	18	579
21.6	43	63	72	200	196	101	44	17	8	7	22	28	801
21.5	68	96	96	237	240	145	79	30	22	23	34	40	1110
21.4	93	128	134	276	279	188	114	63	51	41	52	63	1482
21.3	133	157	156	311	318	229	152	91	77	73	91	86	1874
21.2	175	193	179	337	347	268	187	128	110	90	124	106	2244
21.1	234	240	222	366	375	308	241	167	148	125	157	144	2727
21.0	279	280	262	394	397	344	288	226	190	165	183	183	3191
20.9	347	337	298	405	409	380	326	271	241	203	211	223	3651
20.8	385	369	335	413	419	404	366	318	277	245	249	263	4043
20.7	405	406	384	421	426	415	393	369	329	301	295	321	4465
20.6	423	419	412	428	436	436	436	430	418	412	408	402	5060
20.5	431	427	423	432	436	436	436	436	426	421	419	417	5140
20.4	435	433	436	436	436	436	436	436	436	430	421	427	5198
20.3	436	434	436	436	436	436	436	436	436	436	436	435	5229
20.2	436	436	436	436	436	436	436	436	436	436	436	435	5231
20.1	436	436	436	436	436	436	436	436	436	436	436	435	5231
20.0	436	436	436	436	436	436	436	436	436	436	436	436	5232
Maximum Level	22.16	22.17	22.2	22.48	22.48	22.48	22.04	21.86	21.74	21.94	21.98	22.08	22.48
Minimum Level	20.35	20.21	20.41	20.41	20.63	20.61	20.62	20.55	20.42	20.38	20.38	20.1	20.1

Table B9.

Bv7 Historical Montreal Harbour at Jetty 1 Levels

Montreal Harbour at Jetty #1 Quarter-monthly mean levels Number of Occurences Above Level Shown ... 1900-2008 supplies simulation													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**All Months**
Level (m IGLD 1985)													
9.2	0	0	0	0	0	0	0	0	0	0	0	0	0
9.0	1	1	0	0	0	0	0	0	0	0	0	0	2
8.8	1	1	0	2	1	1	0	0	0	0	0	0	6
8.6	1	3	0	3	9	2	0	0	0	0	0	0	18
8.4	1	5	0	7	22	5	0	0	0	0	0	0	40
8.2	1	5	3	18	40	7	0	0	0	0	0	0	74
8.0	2	5	5	53	66	12	0	0	0	0	0	0	143
7.8	2	7	11	84	85	21	0	0	0	0	0	0	210
7.6	3	15	23	115	103	27	3	0	0	0	0	2	291
7.4	5	22	32	157	132	38	6	0	0	0	6	5	403
7.2	14	32	63	199	181	60	11	3	0	1	7	8	579
7.0	32	51	88	240	224	85	34	13	3	6	15	23	814
6.8	60	86	119	286	273	124	58	23	8	21	27	37	1122
6.6	96	144	152	321	328	185	106	43	37	43	67	65	1587
6.4	139	182	189	350	356	239	155	88	70	75	112	94	2049
6.2	183	224	239	382	375	291	201	144	114	107	144	130	2534
6.0	262	295	287	399	402	343	271	198	174	148	179	185	3143
5.9	300	327	306	410	411	362	296	237	205	176	195	206	3431
5.8	336	352	333	415	419	381	322	272	234	196	214	225	3699
5.7	368	373	361	420	423	396	352	305	267	235	236	252	3988
5.6	384	397	381	427	431	410	380	336	289	267	272	286	4260
5.5	404	414	402	428	434	422	393	373	321	309	316	316	4532
5.4	413	420	417	430	436	426	420	411	392	365	355	359	4844
5.3	427	430	428	432	436	433	434	430	416	406	396	397	5065
5.2	432	433	434	435	436	436	436	435	426	421	412	410	5146
5.1	436	434	435	435	436	436	436	436	431	423	420	426	5184
5.0	436	436	436	436	436	436	436	436	436	430	431	431	5216
4.9	436	436	436	436	436	436	436	436	436	436	436	434	5230
4.8	436	436	436	436	436	436	436	436	436	436	436	435	5231
4.7	436	436	436	436	436	436	436	436	436	436	436	435	5231
4.6	436	436	436	436	436	436	436	436	436	436	436	436	5232
Maximum Level	9.08	9.17	8.34	8.96	8.94	8.9	7.73	7.26	7.19	7.4	7.5	7.69	9.17
Minimum Level	5.11	5.03	5.03	5.06	5.43	5.27	5.21	5.2	5.01	4.94	4.91	4.7	4.7

B5. References

Caldwell, R. and Fay, D.(2002). Lake Ontario Pre-project Outlet Hydraulic Relationship Final Report. Hydrology and Hydraulics Technical Work Group, International Joint Commission Lake Ontario-St. Lawrence River Study.

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International Joint Commission

Directive to the International Lake Ontario - St. Lawrence River Board on Operational Adjustments, Deviations and Extreme Conditions

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This directive was created in conjunction with the proposed revised Order of Approval. It provides specific protocols and guidance to the International Lake Ontario-St. Lawrence River Board for implementing a regulation plan approved by the Commission, particularly as they relate to making operational adjustments, deviating from that plan, and managing extreme conditions. This directive updates and replaces all past directives on these topics to the former International St. Lawrence River Board of Control, including letters from the International Joint Commission (the Commission) dated May 5, 1961 and October 18, 1963 that vested the Board with limited authority to deviate from the approved regulation plan.

Plan 2014 is the combination of the mechanistic release rules labeled "Bv7" (described in Annex B of the June 2014 report on Plan 2014) together with discretionary decisions made by the International Lake Ontario - St. Lawrence River Board to deviate from the flows specified by the rules of Bv7 according to this directive on deviations. In that regard, Bv7 is analogous to Plan 1958-D; each is a set of release rules (algorithms) that produce an unambiguous release amount each week.

Under the 2016 Supplementary Order of Approval, the International Lake Ontario – St. Lawrence River Board is responsible for ensuring compliance with the Order pertaining to the regulation of the St. Lawrence River and Lake Ontario and any requirements outlined in directives from the Commission. This includes setting weekly discharges for the St. Lawrence River through the flow control structures of the Moses-Saunders hydro-electric plant located at Cornwall-Massena according to the regulation plan approved by the Commission. Bv7 release rules are designed to handle a broader range of water supply situations than the previous release rules (Plan 1958-D). In most instances, it will be important to release flows as determined by the release rules in order to realize its expected benefits. Therefore, the Commission anticipates fewer, more limited instances where flow releases would differ from those of the release rules than was the case with 1958-D.

The following sections of this directive describe and differentiate between operational adjustments, minor, major, and emergency deviations. This directive also explains when and how the Board can adjust and deviate from the outflows prescribed by the regulation plan. If the Board cannot establish consensus regarding deviations from plan outflows, then the issue shall be raised immediately to the Commission through the Commission's Engineering Advisors located in Washington, DC and Ottawa, ON. In such cases, the Board must reach consensus on an interim outflow in consideration of the

particular circumstances at the time and that is consistent with the Treaty, while the Commission makes a decision.

Operational Adjustments due to Inaccurate Forecasts

The rules and logic of the regulation plan determine the flow to be released for the coming week based on observed and forecasted hydrologic and ice conditions. As forecasts of conditions have some uncertainty, there will be occasions when the actual within-the-week conditions experienced differ significantly from the forecasted conditions used to calculate the regulation plan flow. Due to inaccurate forecasts, in some cases adjustments to the flows determined by the regulation plan at the beginning of the regulation week will be required later in the week in order to maintain the intent of the plan. The Board will consider these flow adjustments as within-plan operations and not as deviations from the plan.

The rules and logic of the plan provide protection against extreme high and low levels downstream in balance with Lake Ontario levels. The Board shall oversee operational adjustments to successfully manage rapidly varying flood and low flows coming from the Ottawa River in accordance with the rules set out in the regulation plan, unless conditions require minor or major deviations as defined below. The plan also includes rules, based on decades of operational experience, to form and manage the ice cover in the river reaches of importance upstream of the Moses-Saunders and Beauharnois hydro-electric plants. The Board shall also continue flow changes as needed for ice management in these river reaches consistent with the intent of the plan. Ottawa River discharges and St. Lawrence River ice conditions can change significantly from day-to-day, and the week-ahead forecasts of Ottawa River flows and St. Lawrence River ice conditions used for regulation calculations are subject to rapid variations due to changing weather conditions. Therefore, short-term within-the-week flow adjustments will be made when needed to avoid flooding near Montreal consistent with the intent of the plan when the Ottawa River flow is very high and changing rapidly. Such adjustments will also be made when required to maintain St. Lawrence River levels above the minimums specified in the plan when inflows to the river are varying. As ice conditions can vary quickly due to changing weather conditions, it is anticipated that adjustments will also be necessary for the formation of a smooth ice cover to prevent ice jams in the International Rapids Section of the St. Lawrence River and the Beauharnois Canal. Within-the-week flow adjustments may also be required to address other unexpected within-the-week changes in river conditions. These flow adjustments are consistent with and accounted for in the design of the regulation plan, which was developed with the assumption that the flows during the Ottawa River freshet, droughts and the ice formation would be adjusted in practice within the week as they have been with Plan 1958DD. Therefore, no future offsetting adjustments are needed to compensate for within-the-week flow adjustments due to uncertainties in forecasts of Ottawa River flows, St. Lawrence River ice conditions, or other weather-related circumstances that are made to maintain the intent of the Plan.

The Board may direct its Regulation Representatives to be responsible for monitoring conditions, making operational flow adjustments and tracking their use. Tracking records will be used to replicate plan results, as needed for subsequent plan reviews.

Minor Deviations for the St. Lawrence River

To respond to short-term needs on the St. Lawrence River, the Commission will allow the Board to make minor discretionary deviations from the approved regulation plan that have no appreciable effect on Lake Ontario levels. Minor deviations are made to provide beneficial effects or relief from adverse effects to an interest, when this can be done without appreciable adverse effects to other interests and is consistent with the requirements of the Order of Approval. Unlike flow adjustments made to maintain the intent of the plan, minor deviations from the plan require accounting and flow restoration.

Minor deviations, while not necessarily limited to only these situations, could include those to address contingencies such as:

- short-term flow capacity limitations due to hydropower unit maintenance;
- assistance to commercial vessels on the river due to unanticipated low water levels;
- assistance, when appropriate, with recreational boat haul-out on Lake St. Lawrence or Lake St. Louis at the beginning or at the end of the boating season; and,
- unexpected ice problems on the St. Lawrence River downstream of Montreal.

These deviations will affect levels on Lake St. Lawrence and the St. Lawrence River downstream to Montreal, but due to the relatively small volume of water involved, such deviations would have a very minor effect on Lake Ontario levels and the river upstream of Cardinal, ON. The intention is for minor flow deviations to be restored by equivalent offsetting deviations from the plan flow as soon as conditions permit to avoid or minimize cumulative impacts on the Lake Ontario level and avoid changing the balance of benefits under the approved regulation plan. Some discretion will be left to the Board as to whether conditions permit the restoration of the volume of water released or held back by these deviations. However, the Board shall not allow the cumulative effect of these minor deviations to cause the Lake Ontario level to vary by more than +/- 2 cm from that which would have occurred had the releases prescribed by the approved plan been strictly followed. The intent is to accommodate, where possible, those needs of the river interests that are difficult to foresee and build into the plan, while being consistent with the intent of the regulation plan and Order of Approval.

The Board will provide post-action reports to the Commission of these minor deviations from plan flows as part of normal semi-annual reporting requirements. However, if circumstances are such that minor deviations cause the Lake Ontario level to vary more than +/- 2 cm from the level resulting from the approved plan (*i.e.,* potentially having a significant impact on Lake Ontario levels), then the Board shall advise the Commission in advance as soon as the potential need for the longer-term deviation is known. If there is a need for a longer-term deviation, the Board must provide a flow restoration plan and obtain approval from the Commission, or obtain a waiver from the Commission not requiring flow

restoration. It is intended that such a waiver be rarely used so as to avoid changing the balance of benefits associated with the approved regulation plan.

The Board may direct its Regulation Representatives to approve minor deviations from plan flow, within parameters set by the Board.

Major Deviations

Major deviations are significant departures from the approved regulation plan that are made in response to extreme high or low levels of Lake Ontario in accordance with criterion H14 of the revised Order of Approval:

> *In the event that Lake Ontario water levels reach or exceed extremely high levels, the works in the International Rapids Section shall be operated to provide all possible relief to the riparian owners upstream and downstream. In the event that Lake Ontario levels reach or fall below extremely low levels, the works in the International Rapids Section shall be operated to provide all possible relief to municipal water intakes, navigation and power purposes, upstream and downstream. The high and low water levels at which this provision applies, and any revisions to these levels, shall be subject to the concurrence of Canada and the United States and shall be set out in a Commission directive to the Board.*

Major deviations are expected to significantly alter the level of Lake Ontario compared to the level that would occur by following the approved regulation plan. Although the approved regulation plan was developed to perform under a wide range of hydrological conditions and with the experience gained in four decades of regulation operations, extreme high or low Lake Ontario water levels could require major deviations from the plan. Extreme high and low Lake Ontario levels to trigger major deviations are set out in Table 1 of this directive based on quarter-month levels through the year. If the Board expects that lake levels will be outside the range defined by the trigger levels, then based on analysis using the technical expertise at its disposal, the Board will inform the Commission that it expects to make a major deviation from the plan once the trigger level is reached to moderate the extreme levels. The Board is authorized to use its discretion to set flows in such conditions and deviate from the approved plan to provide balanced relief to the degree possible, upstream and downstream, in accordance with criterion H14 and the Treaty. For example, if the lake level is above the high trigger, then the Board could decide to increase the flow to the maximum specified by the limits used in the approved regulation plan if the plan flow is not already at this maximum, or it could apply the maximum flow limits used in Plan 1958DD, or it could release another flow consistent with criterion H14. While major deviations take downstream interests into account, they are not triggered by downstream levels, as the Bv7 release rules are designed to prevent extreme levels downstream, provided that Lake Ontario levels are not at extremes.

The Commission emphasizes that for the objectives of the approved regulation plan to be met, the regulation plan needs to be followed until water levels reach any of the defined triggers. The Board shall keep the Commission informed of the difference between the Lake Ontario level and the defined trigger levels. The Board will provide regular reports on implementation of the major deviation to the Commission. As the extreme event ends, the Board shall develop for Commission approval a strategy to return to plan flows and recommendations as to whether or not equivalent offsetting deviations from the plan flow should be made, as appropriate on a case-by-case basis.

The effectiveness of major deviations initiated with the trigger levels defined in Table 1**Error! Reference source not found.** will be assessed as part of the adaptive management process through follow-up monitoring and modeling. The trigger levels or implementation of major deviations could be modified by the Commission through future directives if warranted.

Emergency Deviations

Emergency situations are considered to be those that threaten the physical integrity of the water management system and that may lead to a loss of the ability to control the flows in the system, or unusual life-threatening situations. Examples could include the failure of a lock gate, flooding of the hydropower control works, failure of a spillway gate, dike failure, a regional power outage, or other such active or imminent incidents. Such incidents arise only on extremely rare occasions. In such cases, immediate action is required and the Board is directed to authorize the Regulation Representatives to direct and approve, on the Board's behalf, emergency flow changes as required. The Regulation Representatives will report any such emergency actions as soon as possible to the Board and immediately thereafter the Board will report such actions to the Commission.

The Board will determine the need to make subsequent equivalent offsetting deviations from the plan flow, as appropriate, on a case-by-case basis.

Signed this xxth day of December 2016.

Secretary
Canadian Section

Secretary
United States Section

TABLE 1 Lake Ontario quarter-monthly high and low water levels to trigger operations according to criterion H14.

Quarter-month of the year		Lake Ontario level (metres IGLD85)		Lake Ontario level (feet IGLD85)*	
		High Trigger	Low Trigger	High Trigger	Low Trigger
1	1-Jan	75.03	74.28	246.16	243.70
2		75.07	74.28	246.29	243.70
3		75.10	74.28	246.39	243.70
4		75.13	74.27	246.49	243.67
5	1-Feb	75.14	74.27	246.52	243.67
6		75.14	74.26	246.52	243.64
7		75.13	74.26	246.49	243.64
8		75.14	74.26	246.52	243.64
9	1-Mar	75.16	74.28	246.59	243.70
10		75.18	74.31	246.65	243.80
11		75.22	74.34	246.78	243.90
12		75.27	74.40	246.95	244.09
13	1-Apr	75.33	74.48	247.15	244.36
14		75.40	74.54	247.38	244.55
15		75.45	74.59	247.54	244.72
16		75.50	74.64	247.70	244.88
17	1-May	75.53	74.67	247.80	244.98
18		75.56	74.69	247.90	245.05
19		75.60	74.72	248.03	245.14
20		75.62	74.74	248.10	245.21
21	1-Jun	75.63	74.75	248.13	245.24
22		75.62	74.75	248.10	245.24
23		75.60	74.76	248.03	245.28
24		75.59	74.76	248.00	245.28
25	1-Jul	75.57	74.75	247.93	245.24
26		75.54	74.75	247.83	245.24
27		75.50	74.74	247.70	245.21
28		75.47	74.72	247.60	245.14
29	1-Aug	75.43	74.70	247.47	245.08
30		75.39	74.68	247.34	245.01
31		75.34	74.65	247.18	244.91
32		75.30	74.62	247.05	244.82
33	1-Sep	75.26	74.59	246.92	244.72
34		75.20	74.56	246.72	244.62
35		75.15	74.53	246.56	244.52
36		75.10	74.50	246.39	244.42
37	1-Oct	75.06	74.47	246.26	244.32
38		75.01	74.44	246.10	244.23
39		74.97	74.41	245.96	244.13
40		74.95	74.39	245.90	244.06
41	1-Nov	74.94	74.36	245.87	243.96
42		74.92	74.35	245.80	243.93
43		74.91	74.33	245.77	243.86
44		74.92	74.32	245.80	243.83
45	1-Dec	74.93	74.31	245.83	243.80
46		74.93	74.31	245.83	243.80
47		74.95	74.29	245.90	243.73
48		75.00	74.28	246.06	243.70

* As regulation operations are conducted in metres, approximate conversions to feet are listed for convenience.

International Joint Commission

International Lake Ontario - St. Lawrence River Board

Directive

This directive updates and replaces the November 16, 1953 directive that created the International St. Lawrence River Board of Control. This directive creates and directs the International Lake Ontario-St. Lawrence River Board as a new Board, with any further direction to the new Board to be issued by the International Joint Commission (the Commission) from this date forward.

Function and Composition of the Board

The International Lake Ontario-St. Lawrence River Board (Board) is responsible for ensuring compliance with the Order of Approval pertaining to the regulation of flows and levels of the St. Lawrence River and Lake Ontario, the regulation plan approved by the Commission and any requirements or duties outlined in directives from the Commission.

The Board shall perform duties specifically assigned to it in the Order of Approval as well as those assigned to it by the Commission directives. Under the Order, the Board has duties related to flow regulation and responsibilities related to adaptive management, communications and public involvement. To carry out these duties, the Board shall meet at least twice a year, hold teleconferences as needed, and provide semi-annual reports to the Commission. It will also follow the Commission's public affairs policy including requirements for regularly meeting with the public.

The Board shall have an equal number of members from each country. The Commission shall determine the number of members (normally a minimum of 10) and shall normally appoint each member for a three-year term. Members may serve for more than one term. Members shall act in their personal and professional capacity, and not as representatives of their countries, agencies or institutions. They are to seek decisions by consensus according to the tradition of the Commission.

Within this binational balance, at least one Board member will be from each of the five jurisdictions – federal, provincial and state. The jurisdictions may nominate members to serve on the Board. The Commission will review nominees, in consultation with the respective nominating federal, state or provincial jurisdiction, to ensure that all Board members are suited to fulfilling the new and continuing responsibilities of the Board. The expertise of potential Board members, their ability to act impartially and effectively with good judgment, their commitment

to work towards Board consensus, engage appropriately with the public and reach decisions quickly when necessary will be key considerations for the Commission in the appointment of candidates to the Board. The Commission will appoint the nominees if it finds them suitable. If the Commission determines a nominee is not suitable, it will request the nominating jurisdiction to make an additional nomination (or nominations) until the Commission determines the nominee is suitable. In addition to members nominated by the jurisdictions, the Commission itself may appoint members to obtain an appropriate balance of expertise and geographic representation on the Board. The Commission shall appoint one member from each country to serve as co-chairs of the Board. Each co-chair is to appoint a Secretary, who, under the general supervision of the chair(s), shall carry out such duties as are assigned by the chairs or the Board as a whole. Upon request to the Commission, either co-chair may appoint an alternate member to act as Chair when they are not available to the Board.

The co-chairs of the Board, through the assistance of the Board secretaries, shall be responsible for maintaining proper liaison between the Board and the Commission, among the Board members and between the Board and its sub-groups. Chairs shall ensure that all members of the Board are informed of all instructions, inquiries, and authorizations received from the Commission and also of activities undertaken by or on behalf of the Board, progress made, and any developments affecting such progress.

In order to provide prompt action which may be necessary under winter operations or emergency conditions, each of the co-chairs of the Board shall appoint a Regulation Representative who is authorized by the Board to act on its behalf in such situations. Among other duties, the Regulation Representatives shall maintain a database of hydrological information for the Board, conduct the regulation plan calculations, make needed within-the-week flow adjustments, coordinate and keep account of flow deviations, and advise the Board on regulation operations.

The Board shall appoint an Operations Advisory Group (OAG) composed of representatives from the operating entities and shall keep the Commission informed of OAG membership. The Board and the Regulation Representatives may consult with OAG members individually or collectively as the occasion requires.

Flow Regulation

The Board shall set flows from Lake Ontario into the St. Lawrence River through the Moses-Saunders Dam and Long Sault Dam in accordance with the Order of Approval, normally as specified by the approved weekly flow regulation plan and directives from the Commission. It shall also approve the gate setting at the Iroquois Dam in consideration of Lake St. Lawrence levels and ice management, which may be delegated to the Regulation Representatives for prompt action.

The Board shall oversee the normal flow variations carried out by the hydropower entities according to the directive on peaking and ponding issued by the Commission. The Board shall also supervise the Regulation Representatives in their conduct of within-the-week flow adjustments and shall direct minor and major flow deviations when required, consistent with the Commission's directive and Order of Approval.

Following the regulation plan will be important over the long-term to ensure that the expected objectives for system regulation are achieved.

Adaptive Management

The Board will take part in an adaptive management strategy designed to verify that the effects of the new regulation plan over time are as anticipated, react to the influence of changing conditions such as climate change, and adapt or improve the implementation of the regulation plan as required. The Board may also use the information acquired through the adaptive management strategy to propose to the Commission modifications to the plan should it learn over time that conditions (climatic, socio-economic or environmental) have changed enough such that the plan is no longer meeting its intended objectives or improvements to the plan could realize increased benefits.

Communications and Public Involvement

The Board is directed to have a communications committee. The aim of the communications committee is to ensure that everyone interested in the regulation of the Lake Ontario-St. Lawrence River system is informed and has opportunities to express personal views regarding regulation. The communications committee will ensure that the Board is proactive in acquiring knowledge about stakeholder needs and perspectives on an ongoing basis and in providing them with regular information about Board decisions and the issues before the Board. The Commission encourages the Board to take advantage of multiple means, including modern technology and alternative communications fora, to better inform and receive input from stakeholders and the public within the framework of the Commission's communication strategy. The Board may collaborate with other Commission boards, governmental and quasi-governmental organizations to effectively strengthen information delivery and involve the public.

The Commission (through its public information officers) shall be informed, in advance, of plans for any public meetings or public involvement in the Board deliberations. The Board shall report in a timely manner to the Commission on these meetings, including representations made to the Board.

The Board shall provide the text of media releases and other public information materials to the Secretaries of the Commission for review by the Commission's Public Information Officers, prior to their release in English and French.

Reports, including semi-annual reports, and correspondence of the Board shall normally remain privileged and be available only to the Commission and to members of the Board and its committees (including appropriate individuals who support these entities with respect to Lake Ontario-St. Lawrence River activities) until their release has been authorized by the Commission. Board members and committees shall maintain files in accordance with the Commission policy on segregation of documents. All Board members shall be provided with these policy documents at the time of their appointment to the Board.

The Board shall provide minutes of Board meetings to the Commission within 45 days of the close of the meeting in keeping with the Commission's April 2002 Policy Concerning Public Access to Minutes of Meetings. The minutes will subsequently be put on the Commission's website.

To facilitate communication between the Board and the relevant federal, state and provincial jurisdictions of the Lake Ontario–St. Lawrence River system, the Commission shall request from these jurisdictions the name of an appropriate contact person and provide these names to the Board. The Board should note that its communications with the jurisdictions are only with respect to the carrying out of the functions of the Board, as set out in the Order of Approval and associated directives. It will remain the role of the Commission to engage all the jurisdictions (federal, state, provincial), as appropriate in the consideration of any changes to the regulation plan or directives to the Board. Any issues raised by the jurisdictions with the Board in these respects should be redirected to the Commission.

Other Aspects

According to need and on an ad-hoc basis, the Board may establish any other committees and working groups as may be required to discharge its responsibilities effectively. The Commission shall be kept informed of the duties and composition of any committee or working group. Commissioners and relevant Commission staff are invited to any meetings of the Board and any committees the Board may establish. Unless other arrangements are made, members of the Board, committees, or working groups will make their own arrangements for reimbursement of necessary expenditures. The Commission should also be informed of the Board's plans and progress and of any developments or cost impediments, actual or anticipated, that are likely to affect carrying out the Board's responsibilities.

If, in the opinion of the Board or of any member, any instruction, directive, or authorization received from the Commission lacks clarity or precision, then the matter shall be referred

promptly to the Commission for appropriate action. In the event of any unresolved disagreement among the members of the Board, the Board shall refer the matter forthwith to the Commission for decision.

Signed this xxth day of December 2016.

Secretary Canadian Section	Secretary United States Section