

**One Hundred and Twenty-fifth Progress Report
to the
International Joint Commission
by the
International St. Lawrence River Board of Control
Covering the Period
1 September 2015 through 29 February 2016**



29 February 2016

Cover Photo: Lake St. Lawrence during extreme southwest winds and record high temperatures on 24 December 2015 (Credit: Jacob Bruxer)

Executive Summary

Regulation Strategy and Results

Lake Ontario ended the month of August at its highest level since 1992. Above-average water supplies, fluctuating water levels on Lake St. Lawrence, the first spill event since 1998 at the Long Sault Dam spillway, excess water stored on Lake Ontario from the August tug salvage operation, and ice management all presented challenges to regulation during the reporting period.

The Board followed plan-prescribed outflows for most of September. However, outflows were reduced late that month due to Lake St. Lawrence falling below the Seaway low alert level. Outflows were reduced twice in October, first to raise levels of Lake St. Lawrence and assist residents with recreational boat haul-outs, and later to reduce the amount of water spilled at the Long Sault Dam spillway. Flows were increased from 23 October to 10 November to remove stored water on Lake Ontario. Outflows were then reduced to increase levels in Lake St. Lawrence once again. Over-discharges then continued into December to continue removal of stored water. All remaining stored water was removed by 25 December. Incremental reductions were undertaken thereafter in late January and early February to facilitate the formation of stable ice covers in the St. Lawrence River. This stored water was then partially removed during a series of further over-discharges. On 29 February, 4.9 cm (1.9 in) of water remained stored on Lake Ontario.

Lake Ontario received above-average water supplies throughout the entire reporting period. All were within the range of those used in the design of the regulation plan, Plan 1958-D. Lake Ontario levels began the month of September at 19 cm (7.5 in) above average, fell below average from the end of November through December, then rose above average through February. No violations of criterion h, j, or k occurred during the reporting period. Thus water levels on Lake Ontario and in the St. Lawrence River were maintained within the criteria specified in the 1956 Amended Orders of Approval of the International Joint Commission (IJC).

On 29 February 2016, the level of Lake Ontario was 30 cm (11.8 in) above average.

Board Activities

The Board met in person twice during the reporting period to conduct business, assess conditions, and affirm its outflow strategy. Regulation representatives continued to provide the Board with weekly

information on conditions in the system, monthly assessments of hydrologic conditions and forecasts, and risk assessments. The Board reviewed the information each month through emails. The Operations Advisory Group continued its weekly teleconference to apprise the regulation representatives of operational requirements and constraints. The Great Lakes - St. Lawrence River Adaptive Management Committee presented its first annual work plan and communication strategy to the Board, and gained approval of these items in October. In December, Canadian Co-Chair Morel accepted a position at the Department of Fisheries and Oceans Canada (DFO). Mr. Morel will continue as co-chair until the IJC appoints a replacement from Environment and Climate Change Canada (ECCC). Mr. Arun Heer was officially appointed US secretary on 9 December following his temporary appointment which began 20 April 2015. A Board membership vacancy remains for the US section.

Communication Activities

The communication committee was very active in 2015, and completed its strategic communication plan in support of IJC 2015-2020 strategic communication goals. A comprehensive summary of annual activities is provided in Appendix A.

Board members presented the standard presentation to three separate stakeholder groups during this reporting period, and held a teleconference/webinar on 15 September. The Board also posted the presentation materials on its website beforehand for public access. The joint Board-IJC communications committee continues to provide advice and assistance on a variety of issues, including a standard Board presentation and the opening of a Flickr account to allow for online photo sharing, and is currently in the process of developing short educational video segments to be shared online. ECCC supported the Board's communications efforts by providing additional staff to assist the Board's communication efforts, with their responses to a number of public inquiries and requests for information, and improving its communications effectiveness through the use of its Facebook site.

Appendix B provides the same background material as was in the semi-annual reports of the Board to the IJC prior to 2010. Providing the material in this manner allows this report to be focused on the issues and conditions of the current reporting period, allowing the interested reader to refer to this appendix for the background information.

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1 Hydrological Conditions

1.1 Lake Ontario basin - net basin supply

The local net basin supplies (NBS) to Lake Ontario (see Appendix B for definition) were near average from September through January and above average in February. Monthly NBS values for September through February and for the total six-month period are provided in Table 1. Over the six-month period, local net basin supplies were above average, having been exceeded 30 percent of the time.

1.2 Precipitation

Monthly precipitation amounts for the Lake Ontario and Great Lakes basins, and the average for the total six-month period are provided in Table 2. Precipitation over the Lake Ontario basin was above average in September, October and February, near average in December and well-below average in November and January. The six-month average amount of this basin's precipitation was 71 mm (2.8 in.) per month, which was below average, having been exceeded 62 percent of the time. The six-month average precipitation for the entire Great Lakes basin was 63 mm (2.5 in.) per month, which was also below average, having been exceeded 60 percent of the time.

1.3 Supply from Lake Erie

The inflows to Lake Ontario from Lake Erie during the reporting period are provided in Table 1. With Lake Erie's level above average from September through February, monthly means flows to Lake Ontario were above average throughout the reporting period. Based on the historical record, the six-month average outflow would be expected to be exceeded only 14 percent of the time.

1.4 Lake Ontario – net total supply

The monthly net total supplies to Lake Ontario are provided in Table 1 and shown graphically in Figure 1. The six-month net total supplies for the past ten years are provided in Table 3 for comparison purposes. The monthly net total supplies were above average from September through February. Overall, the total supply was 113 percent of the long-term average during this reporting period and has been exceeded only 16 percent of the time.

1.5 Ottawa River basin

Figure 2 shows the Ottawa River flows. Ottawa River outflows started the reporting period near the September average, and quickly fell in October to near record minimums for that month. Outflows then sharply rose, approaching the maximum for the last week in December, remaining well-above average for the months of January and February.

2 Regulation of Flows and Levels

2.1 Board's regulation strategy and resulting actions

In order to be responsive to the conditions and needs of interests in the Lake Ontario – St. Lawrence River system, the Board assessed conditions throughout the period: in meetings twice and through numerous email exchanges, and developed outflow strategies with the aid of regular monthly reports from the regulation representatives that reviewed conditions.

In summary, the Board's strategy in September was to release outflows according to the plan-prescribed values, permit under discharges to assist in the haul-out of recreational vessels on Lake St. Lawrence, promptly remove water stored on Lake Ontario prior to the end of December 2015, and allow additional under- or over-discharges that would be necessary to address unforeseen critical conditions. Incremental reductions were undertaken in late January and early February to facilitate the formation of stable ice covers. This stored water was then partially removed during a series of over-discharges. Figure 3 shows the actual Lake Ontario outflows for the period 1 September 2015 to 29 February 2016, in comparison to the long-term average, calculated preproject and 1958-D Plan-specified outflows. Fluctuating water levels in Lake St. Lawrence, as shown in Figure 4, and other factors resulted in many deviations throughout the reporting period. These deviations are discussed in further detail in the following section.

2.2 Deviations from Regulation Plan 1958-D

Table 4 summarizes the Board's discretionary deviations during the reporting period. As seen in the table, deviations were made throughout the reporting period consistent with the regulation strategy. The Board followed plan-prescribed outflows for most of September. However, outflows were reduced on 25 September and 30 September due to Lake St. Lawrence falling below the Seaway low alert level due to temporary water level fluctuations during periods of strong northeast winds. In October, outflow was first reduced on 10 and 11 October to raise water levels on Lake St. Lawrence to assist residents with recreational boat haul-outs. On 13 and 14 October, transmission congestion issues in the New York

Control Area temporarily limited the amount of water that could be passed by the New York Power Authority through the Moses Generating Station. To achieve plan-flow during this time, NYPA spilled water through the Long Sault Dam spillway starting on 13 October. On 14 October, the total outflow was reduced below the plan-prescribed amount to avoid further spillage through the spillway. Plan-prescribed flow resumed until 23 October, and flows were increased thereafter to remove stored water on Lake Ontario. Over-discharges continued until 10 November, when outflows were reduced to increase levels in Lake St. Lawrence once again due to that lake reaching the Seaway low alert level during strong northeast winds. Over-discharges resumed 12 November to continue removal of stored water. Removal of stored water continued in December. All remaining stored water was removed by 25 December. Incremental reductions were undertaken thereafter in late January and early February to facilitate the formation of stable ice covers in the St. Lawrence River. This stored water was then partially removed during a series of further over-discharges. As of 29 February, 4.9 cm (1.9 in) of water remained stored on Lake Ontario.

2.3 Iroquois Dam operations

From 14 to 16 September, Iroquois Dam gates 8-11 were fully closed to permit repairs to the equipment that monitors the eel passage. Additionally, gates 8-13 were fully closed from 14 to 16 October to permit the removal of this equipment.

2.4 Results of regulation

2.4.1 Upstream

Lake Ontario

The effects of Regulation Plan 1958-D and the Board's outflow strategy on the levels of Lake Ontario are shown in Figure 5. For comparison purposes, the daily levels of 2014, 2015 and 2016 through the reporting period are shown. During this period, levels started above average and remained above average until November, when they dropped below average through the end of December. Levels quickly rose to above average entering January and continued to rise through February. At the end of the period, the level was at 74.91 m (245.76 ft.), 30 cm (11.8 in) above the long-term average.

As a means of determining the impact of regulation activities on levels and outflows, the Board provides the IJC with a comparison of Lake Ontario's actual monthly levels and outflows to those that would have occurred under preproject conditions (that is, the levels and outflows that would have occurred had regulation not been undertaken). A summary of this comparison for the reporting period is given in Table 5.

This shows that Lake Ontario ranged from 33 cm (13.0 in) to 57 cm (22.4 in) lower than it would have been without regulation. A comparison of the daily levels to long-term average, and weekly computed Plan 1958-D levels is also shown in Figure 6.

Lake St. Lawrence

As shown in Figure 4, the water levels of Lake St. Lawrence started the reporting period well below average due to relatively high Lake Ontario outflows, and temporarily approached record lows near the end of September during sustained northeast winds. High Lake Ontario outflows continued to draw down Lake St. Lawrence, keeping levels generally below average through November, and, again, briefly approaching record lows several times. Levels climbed above average towards the end of December and continued above average through February, temporarily approaching record highs in both January and February. On 29 February, the water level was 72.95 m (239.33 ft), 42 cm (16.5 in) above the long-term average.

2.4.2 Downstream

Lake St. Francis

Daily water levels at Summerstown on Lake St. Francis fluctuated near average until late December, then fell below average as flows were decreased for ice formation, and remained below average through mid-February. Levels then rose as flows were increased and finished the reporting period near average.

Lake St. Louis

Lake St. Louis water levels began September above average and fell to average by the end of the month, where they fluctuated near average until January. From January through mid-February, levels were below average, and then rose sharply to above average as a result of increased outflows from Lake Ontario combined with relatively high Ottawa River flows. As shown on Figure 7, the water levels on Lake St. Louis were above the Seaway low alert level of 20.6 m (67.6 ft) throughout the reporting period.

Port of Montreal

The daily levels at the port began September near average, and fell to below average by the end of the month. Levels generally remained below average through mid-February, before rising sharply above average. Water levels remained above chart datum throughout the reporting period. Figure 8 indicates the daily water levels in the port.

3 Board Activities

3.1 Board meetings & conference calls

The Board continued to oversee the operations of the hydropower project in the international reach of the St. Lawrence River. The Board, primarily through the offices of the regulation representatives, monitored conditions throughout the Lake Ontario-St. Lawrence River system. Regulation representatives provided the Board with: weekly regulation data; monthly reviews of hydrological conditions; risk analyses using water level outlooks; and advised the Board on regulation strategy options and their potential impacts on water levels and interests throughout the system. The Board's Operations Advisory Group (OAG) held weekly teleconferences to review conditions and advise regulation representatives on weekly operational requirements and constraints. The St. Lawrence River Committee on River Gaging continued to monitor the power entities' program for operation and maintenance of the gaging system required for Board operations, hold teleconferences and report annually.

The Board continued to assess conditions in the basin and adjust or affirm its regulation strategy accordingly. Conditions were such that the Board used email exchanges monthly, since more in-depth consultation to revise or affirm the regulation strategy was unnecessary. During the reporting period, the Board held face-to-face meetings on 23 September in Montreal, QC, and 28 October in Ottawa, ON. Table 6 provides a list of board members in attendance at the meetings.

3.2 Meetings with the public and input from the public

The Board conducted a public teleconference/webinar the evening of 15 September 2015 to allow the public direct access to the Board. The Board provided toll-free telephone access in French and English with simultaneous translation and remote access via webinar and prior posting of the slides on its website. Twelve people participated in the teleconference/webinar.

During the reporting period, the communications committee, individual board members, the secretaries and the regulation representatives were actively engaged in outreach, information exchange and liaison with stakeholders throughout the Lake Ontario-St. Lawrence River system, including through presentations to stakeholder groups as referenced in Appendix A and the Board's strategic communications plan. Board members and staff responded to a number of inquiries and requests for interviews from the media and the general public concerning water level conditions and the effectiveness of the board's strategies. Weekly postings on the Board's Facebook pages occur in both French and English, with total "likes" at 34 for the French page and over 655 for the English page. The Board's posts reached 475 people on average in a single week, with more interest after posting the monthly hydrologic summary.

3.3 Board and committee membership changes

In December, Canadian Co-Chair Morel accepted a position at Fisheries and Oceans Canada (DFO). Mr. Morel will continue as co-chair until the IJC appoints a replacement from ECCC. Mr. Arun Heer was officially appointed US secretary on 9 December 2016 following his temporary appointment which began on 20 April 2015. A US section Board membership vacancy remains.

4 Communications Committee Report

The Board continued to work with the IJC through the Communications Committee, to seek opportunities to improve communications with the public. The regulation representatives joined the committee to assist with the explanations of technical details. ECCC provided communications assistance to the Board. A complete annual summary of the committee's activities can be found at the end of this report in Appendix A.

Communication activities during the reporting period included:

- Preparation of media releases: The Board issued media releases after each board regulation decision and on an as-needed basis to provide the public with up-to-date information on basin conditions and noteworthy activities;
- Held a public meeting via teleconference/webinar on 15 September;
- Continued operation of the Board's website on the internet, http://www.ijc.org/en/_/islrbc/home. The website includes:
 - Slider photos indicating interests in the Lake Ontario – St. Lawrence River system
 - Weekly updates on water levels, outflows and water supply information;

- General information about the Board, its activities and its structure;
- Announcements about the Board's outflow strategies and "related media" releases;
- A list of frequently asked questions and responses; and
- A posting of the Board's semi-annual progress reports, meeting minutes, teleconference summaries and data updates;
- Weekly and monthly updates of the Board's English (www.Facebook.com/ISLRBC) and French (www.Facebook.com/CICFSL) Facebook pages, and frequent interaction with the public through the Facebook page; and
- Flickr account set up to provide publicly accessible photos.

The regulation representatives also sent weekly updates on Lake Ontario regulation and water level and outflow conditions to almost 300 e-mail subscribers. Stakeholders are encouraged to subscribe to this free service.

5 Adaptive Management Committee

The IJC established the St. Lawrence River - Great Lakes Adaptive Management Committee (GLAM) of technical experts in early 2015 to adopt adaptive management methods as part of an ongoing review and evaluation of regulation plans, as well as to implement the outstanding science of past studies. The Board plans to utilize GLAM to evaluate regulation plan performance over time with regard to a broad range of environmental and economic indicators.

The GLAM presented its first annual work plan and communication strategy to the Boards at the 23 September meeting and later to the IJC on 28 October during the semi-annual meeting. The Boards and IJC approved GLAM's annual work plan and communication strategy, which can be found in Appendix C.

6 Gaging Committee

The Board's St. Lawrence Committee on River Gaging monitors the power entities' program for maintaining gages required for the Board to monitor water levels and flows.

6.1 Overview

The Board's committee on river gaging ensures the accuracy of flow estimates and water level measurements. This includes inspections of computational methods at each of the eight outflow structures

and the 15 water level gages used by the board to monitor river conditions. Audits of the power entities' data processing are also conducted by an inspection team under the direction of the committee. The inspection team prepares an annual report to the gaging committee. Operation and maintenance of the water level gages are performed by the power entities and the Canadian Hydrographic Service. The gauging committee's (inspections) guidelines document was presented to the Board for review and approval on 23 September.

6.2 Gage network inspection

The committee is responsible for annual inspections of the water level gaging network and provides the Board with an annual report on inspection results. The 2013 Gaging Report was approved by the Board and posted on the SharePoint site. The seventy-eighth (2014) report is currently in progress and is expected to be distributed for review during the April board meeting in Washington DC. The gaging committee conducted the 2015 water level gage inspection in October with financial assistance from the IJC for NOAA members. Discussions on future funding and agency responsibilities are still ongoing.

6.3 Raisin River diversion

The Raisin River diversion remained open from the beginning of the reporting period until 24 September. Flow rates ranged from 0 to 0.02 m³/s (0.7 cfs) during this period.

7 St. Lawrence Seaway Report

The Seaway navigation season for the Montreal-Lake Ontario Section officially closed Wednesday, 30 December 2015 with the last vessel, the Baie St. Paul, transiting the St. Lambert Lock at 20:41.

8 Hydropower Peaking & Ponding

By letter dated 13 October 1983, the IJC authorized OPG and NYPA to continue to carry out peaking and ponding operations at the St. Lawrence project. The conditions governing peaking and ponding operations are specified in Addendum No. 3 to the *Operational Guides for Regulation Plan 1958-D*. On 28 November 2011, the IJC renewed the approval for a five-year period, dated 1 December 2011 to 30 November 2016

Peaking operations were conducted throughout the reporting period. No ponding operations were conducted. A specific request to be able to peak when daily flows were over 7930 m³/s to allow switching transfers from OPG to Hydro Quebec was approved by the IJC during the previous reporting period.

Respectfully submitted,

Members for the United States



BG Kaiser, Chair


T. Brown


R. Campary


F. Sciremammano

Members for Canada


P. Morel, Chair


J. Aubry-Morin


P. Clavet


J. Frain


M. Hudon

Table 1: Monthly Mean Supplies to Lake Ontario

Month	Inflow from Lake Erie				Local Net Basin Supplies			Total Supplies			
	m ³ /s	tcfs	Exceed. Prob. ⁽¹⁾	Percent of LTA ⁽¹⁾	m ³ /s	tcfs	Exceed. Prob. ⁽¹⁾	m ³ /s	tcfs	Exceed. Prob. ⁽¹⁾	Percent of LTA ⁽¹⁾
Sep 15	6,620	234	15	111	260	9	32	6,880	243	13	114
Oct 15	6,390	226	20	109	170	6	51	6,560	232	28	108
Nov 15	6,440	227	17	110	460	16	58	6,900	244	31	107
Dec 15	6,270	221	25	107	950	34	41	7,220	255	30	108
Jan 16	6,560	232	11	115	1,100	39	39	7,660	271	19	115
Feb 16	6,510	230	10	117	1,940	69	7	8,450	298	4	127
6-month Average	6,470	230	14	112	810	30	30	7,280	260	16	113

⁽¹⁾ Based on period of record 1900-2015

Table 2: Provisional Precipitation over Great Lakes & Lake Ontario Basins

Month	Great Lakes Basin			Lake Ontario Basin		
	mm (inches) ⁽¹⁾	Percent of LTA ⁽²⁾	Exceed. Prob. ⁽³⁾	mm (inches) ⁽¹⁾	Percent of LTA ⁽²⁾	Exceed. Prob. ⁽³⁾
Sep 15	74 (2.91)	85	70	93 (3.66)	112	35
Oct 15	70 (2.76)	95	56	86 (3.39)	108	39
Nov 15	61 (2.40)	87	66	39 (1.54)	49	95
Dec 15	86 (3.39)	141	6	76 (2.99)	101	46
Jan 16	41 (1.61)	73	82	45 (1.77)	65	89
Feb 16	45 (1.77)	100	48	88 (3.46)	147	9
6-month Average	63 (2.47)	97	60	71 (2.80)	96	62

⁽¹⁾ Provisional

⁽²⁾ Based on period of record 1900-2015

⁽³⁾ Based on period of record 1900-2013

Table 3: Average & Recorded Six-Month Total Supplies (Sep-Feb)

	Long-Term Average ⁽¹⁾		Recorded			Recorded Below (-) or Above Average (+)		
	(m ³ /s)	(tcfs)	(m ³ /s)	(tcfs)	Exceed. Prob. ⁽¹⁾	(m ³ /s)	(tcfs)	Percent
Sep 06 – Feb 07	6,430	227	7,590	268	9	1,160	41	18
Sep 07 – Feb 08	6,430	227	6,540	231	43	110	4	2
Sep 08 - Feb 09	6,430	227	6,910	244	28	480	17	7
Sep 09 - Feb 10	6,430	227	6,500	230	45	70	2	1
Sep 10 – Feb 11	6,430	227	6,270	221	56	-160	-6	-2
Sep 11 – Feb 12	6,430	227	7,540	266	10	1,110	39	17
Sep 12 - Feb 13	6,430	227	6,130	216	62	-300	-11	-5
Sep 13 - Feb 14	6,430	227	6,520	230	44	90	3	1
Sep 14 - Feb 15	6,430	227	6,470	228	46	40	1	1
Sep 15 – Feb 16	6,430	227	7,280	257	16	850	30	13

⁽¹⁾ Based on period of record 1900-2015

Table 4: Summary of Outflow Deviations from Regulation Plan 1958-D Flow

Date 2015-2016	Deviation (cms)	Dev. (cms- wks)	Acc. Dev. rounded (cms- wks)	Cum. Effect on Lake Ont. rounded (cm)	Reason for Deviation
Sep 1			-630	2.0	
Sep 25	-160 for 24 hrs	-23	-650	2.0	Raise Lake St. Lawrence Levels
Sep 30-Oct 1	-280 for 36 hrs	-60			Raise Lake St. Lawrence Levels
Oct 2	-480 for 24 hrs	-69	-780	2.4	Raise Lake St. Lawrence Levels
Oct 3-4	-610 for 48 hrs	-174			Raise Lake St. Lawrence Levels
Oct 5	-310 for 13 hrs	-24	-980	3.0	Ramp to plan flow
Oct 10-11	-1,090 for 39 hrs	-253			To aid Lake St. Lawrence boaters with haul-out
Oct 11	-520 for 1 hr	-3			Ramp to plan flow
Oct 14	-600 for 8 hrs	-29	-1,270	3.9	Reduce Long Sault Dam spill
Oct 24-30	140 for 168 hrs	140	-1,130	3.5	Reduce stored water
Oct 31-Nov 6	130 for 24 hrs	130	-1,000	3.1	Reduce stored water
Nov 7-10	80 for 168 hrs	43			Reduce stored water
Nov 10-12	-220 for 43 hrs	-56	-1,010	3.1	Raise Lake St. Lawrence Levels
Nov 14-20	20 for 168 hrs	20	-990	3.1	Reduce stored water
Nov 28-Dec 1	250 for 96 hrs	143			Reduce stored water
Dec 2-4	30 for 72 hrs	13	-830	2.6	Reduce stored water
Dec 5-11	290 for 168 hrs	290	-540	1.7	Reduce stored water
Dec 19-25	540 for 168 hrs	540	0	0.0	Reduce stored water
Dec 26-Jan 1	280 for 168 hrs	280	280	-0.9	To smooth the transition in flows
Jan 20-22	-330 for 58 hrs	-114	170	-0.5	Ice Management (Beauharnois Canal)
Jan 23-27	-330 for 110 hrs	-216			Ice Management (Beauharnois Canal)
Jan 29	270 for 24 hrs	39	-10	0.03	Ice Management
Jan 30-Feb 5	-300 for 168 hrs	-300	-310	1.0	Ice Management
Feb 6-9	-560 for 96 hrs	-320			To smooth the transition in flows
Feb 10	-860 for 24 hrs	-123			Ice Management (Beauharnois Canal)
Feb 11-12	-1,130 for 48 hrs	-323	-1,080	3.3	Ice Management (Beauharnois Canal)
Feb 13-15	-1,130 for 72 hrs	-484			Ice Management (Beauharnois Canal)
Feb 16	-760 for 24 hrs	-109			Ramp to plan flow
Feb 17	-360 for 24 hrs	-51	-1,720	5.3	Ramp to plan flow
Feb 23-26	160 for 96 hrs	91	-1,630	5.0	Reduce stored water
Feb 27-29	90 for 72 hrs	39	-1,590	4.9	Reduce stored water

Table 5: Lake Ontario Recorded and Preproject Levels and Outflows

Month	Lake Ontario Monthly Mean Water Levels (IGLD 1985) - meters (feet)			Lake Ontario Monthly Mean Outflow m ³ /s (tcfs)		
	Recorded	Preproject	Diff.	Recorded	Preproject	Diff.
Sep 15	74.91 (245.76)	75.24 (246.85)	-0.33 (-1.09)	8,480 (299)	7,590 (268)	890 (31)
Oct 15	74.67 (244.98)	75.11 (246.42)	-0.44 (-1.44)	7,910 (279)	7,320 (259)	590 (21)
Nov 15	74.56 (244.62)	75.09 (246.36)	-0.53 (-1.74)	7,820 (276)	7,260 (256)	560 (20)
Dec 15	74.47 (244.32)	75.04 (246.19)	-0.57 (-1.87)	6,960 (246)	7,170 (253)	-210 (-7)
Jan 16	74.63 (244.85)	75.09 (246.36)	-0.46 (-1.51)	6,180 (218)	7,300 (258)	-1,120 (-40)
Feb 16	74.81 (245.44)	75.16 (246.58)	-0.35 (-1.14)	7,010 (248)	7,410 (262)	-400 (-14)

Table 6: Attendance at Meetings (1 September 2015 – 29 February 2016)

Board Member	Country	23 Sept	28 Oct
BG R. Kaiser ¹	U.S.	-	X
Mr. P. Morel ²	Can.	X	X
Mr. J. Aubry-Morin	Can.	X	X
Mr. T. Brown	U.S.	X	X
Mr. R. Company	U.S.	X	X
Ms. P. Clavet	Can.	X	X
Mr. S. Durrett ³	U.S.	X	-
Ms. J. Frain	Can.	X	X
Mr. M. Hudon	Can.	X	X
Dr. F. Sciremammano, Jr.	U.S.	-	X

Notes: 1. US Co-Chair
2. Canadian Co-Chair
3. US Alternate Co-chair

Location of Meeting:

23 September 2015: Montreal, QC, Canada

28 October 2015: Ottawa, ON, Canada

Figure 1: Monthly Net Total Supplies to Lake Ontario

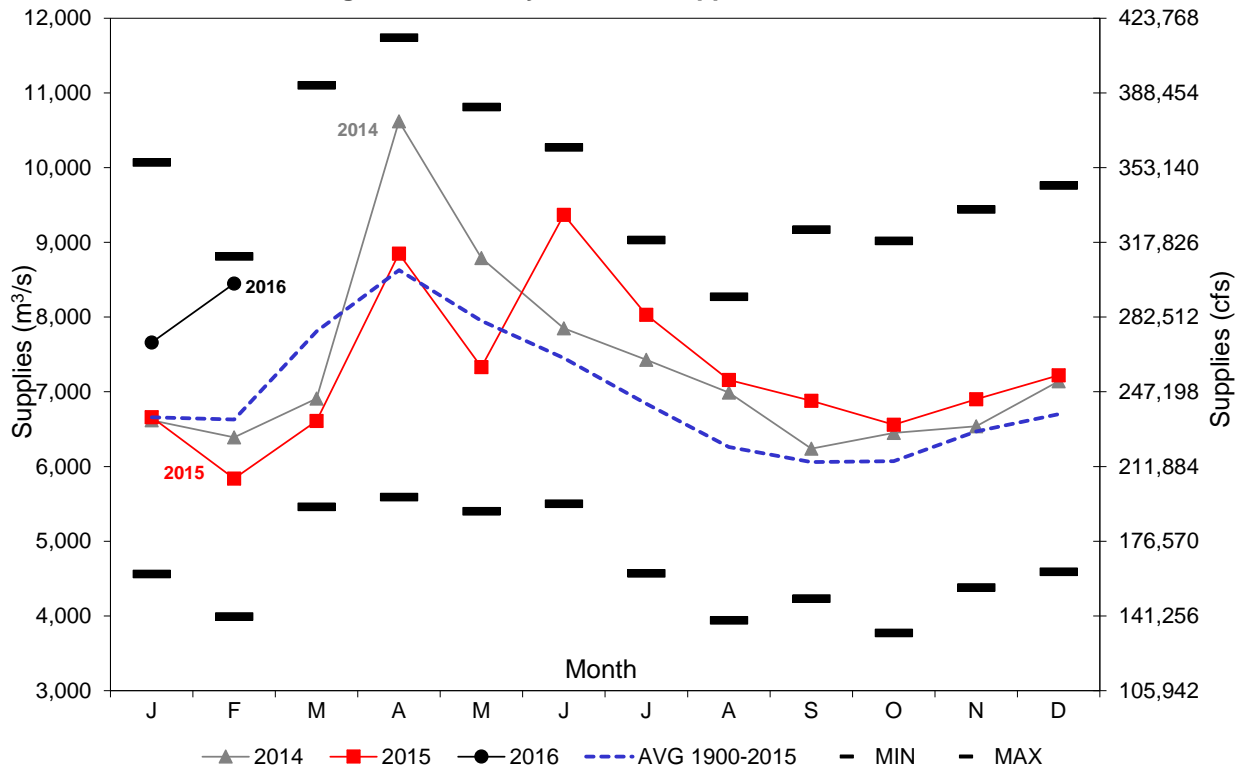


Figure 2: Daily Ottawa River Flow @ Carillon

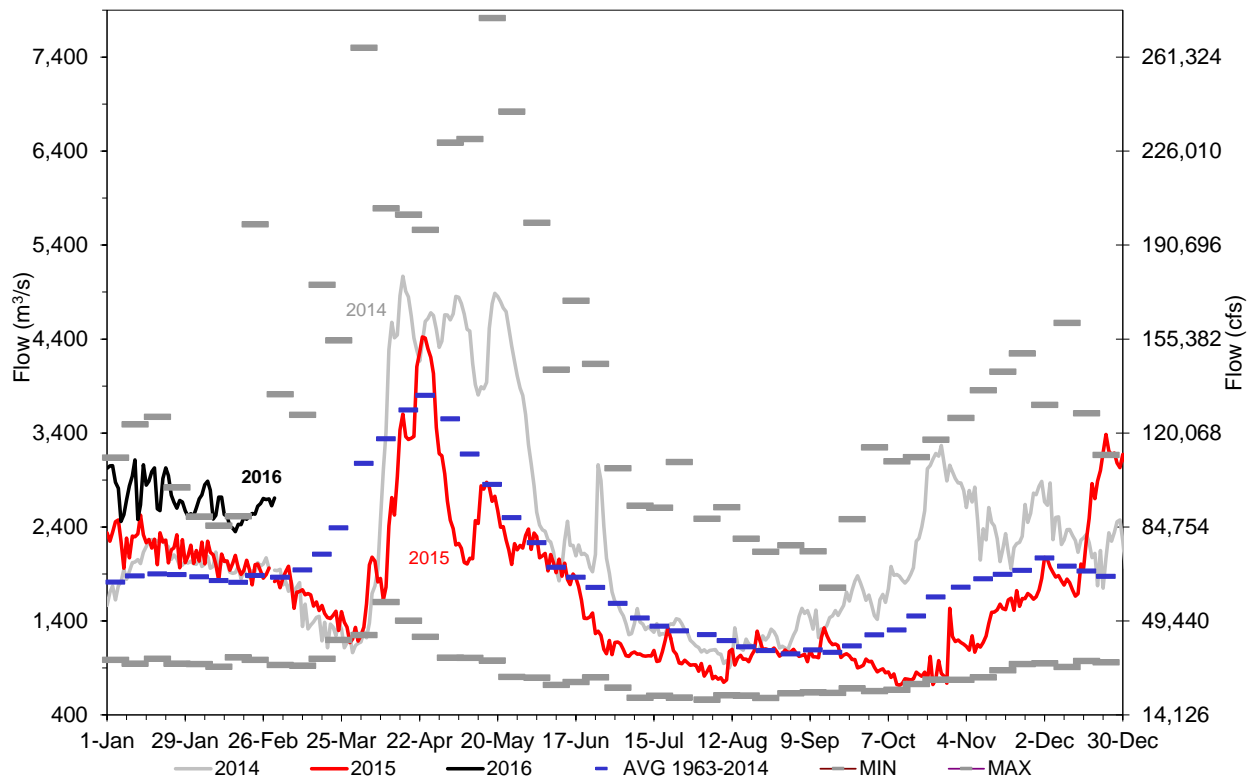


Figure 3: Lake Ontario Daily Outflows

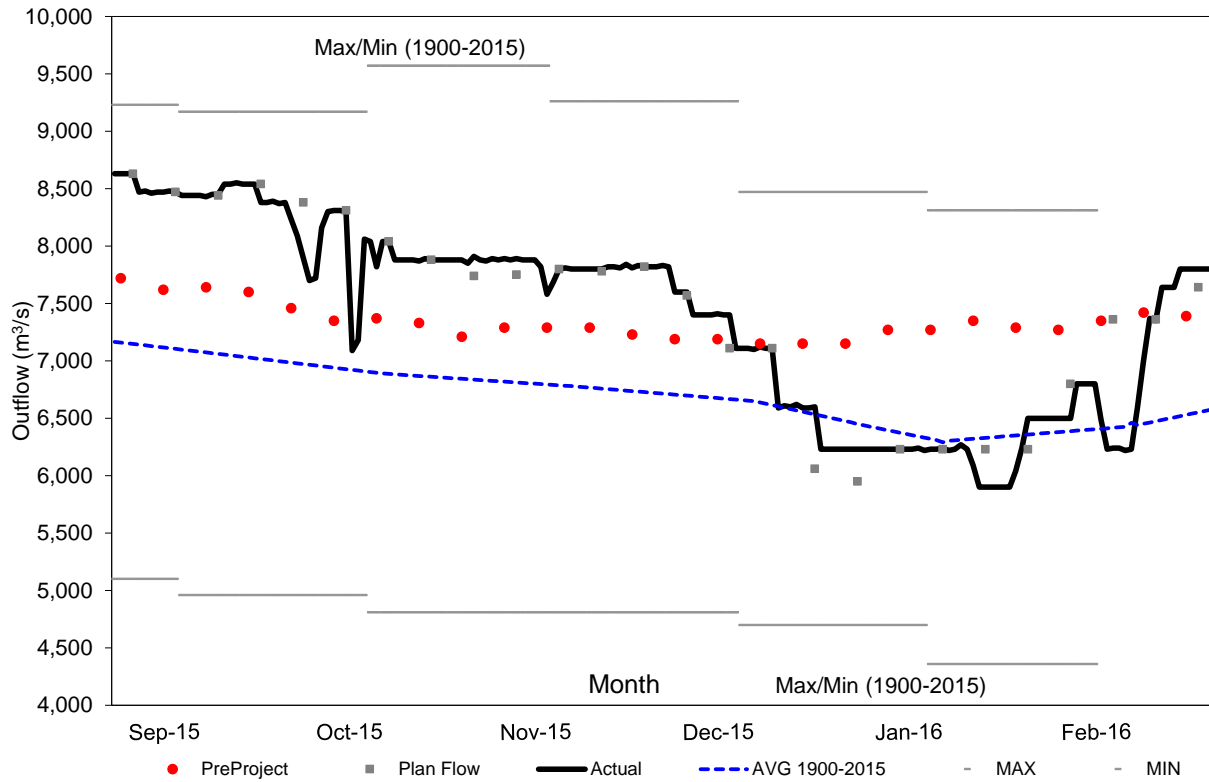


Figure 4: Daily Lake St. Lawrence Levels @ Long Sault Dam

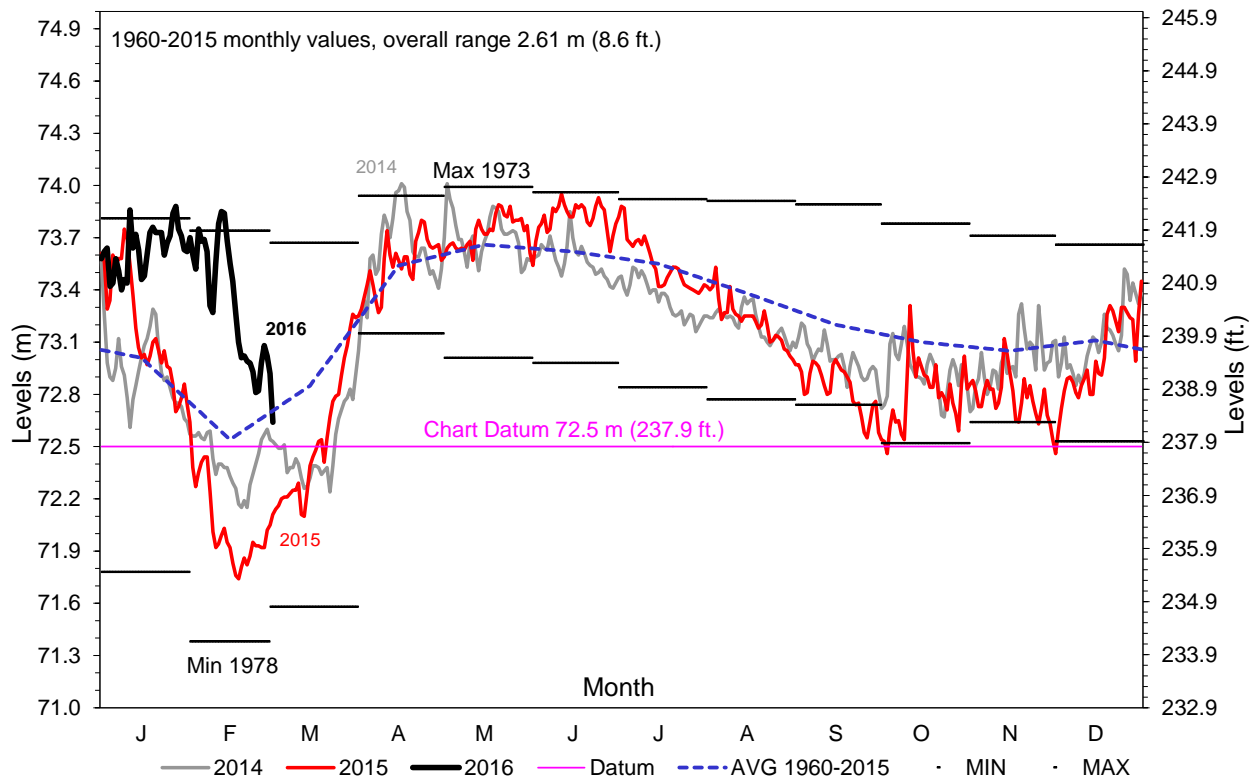


Figure 5: Daily Lake Ontario Water Levels

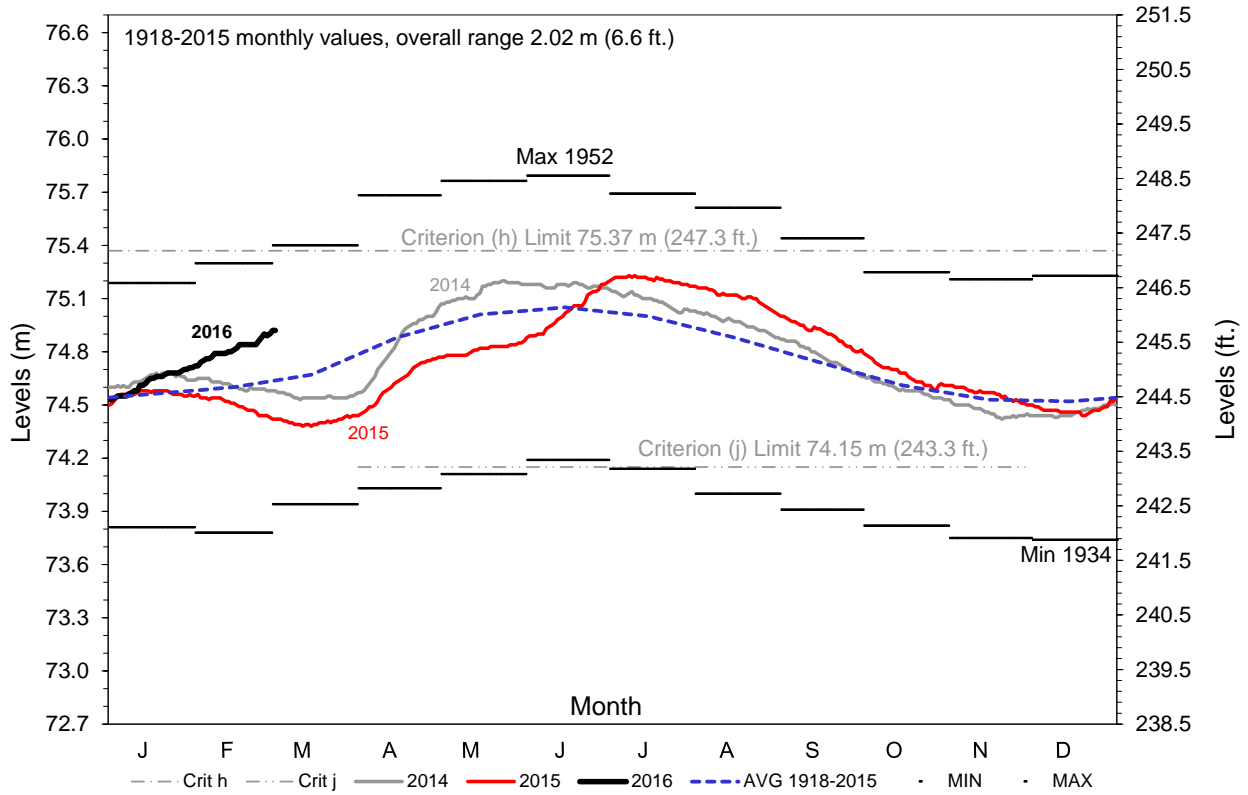


Figure 6: Lake Ontario Actual, Preproject & Plan Levels

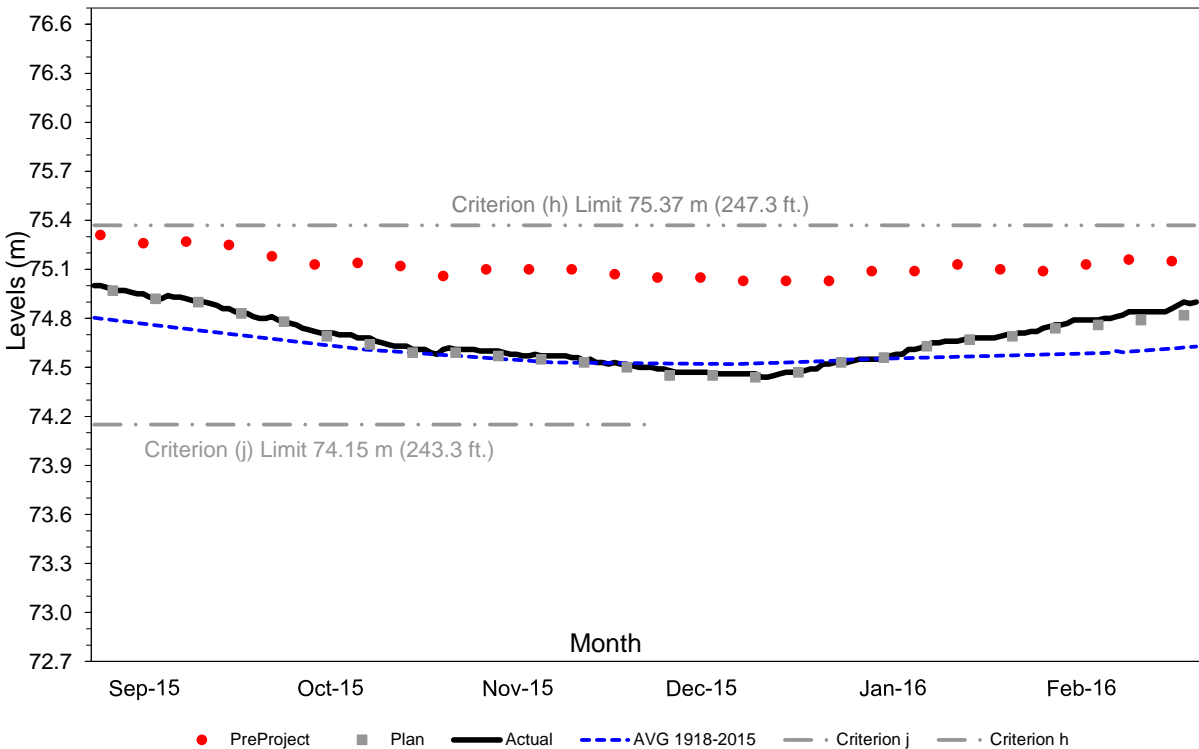


Figure 7: Daily Lake St. Louis Levels @ Pointe-Claire

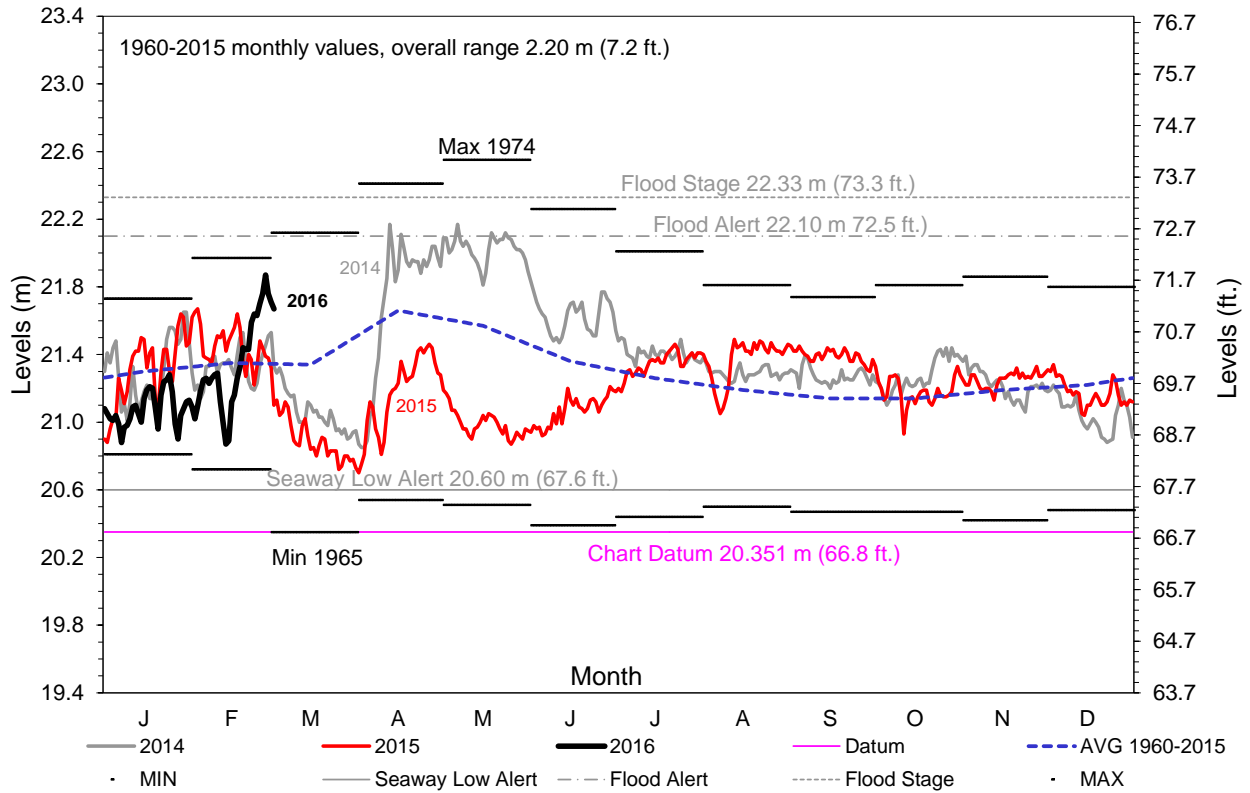
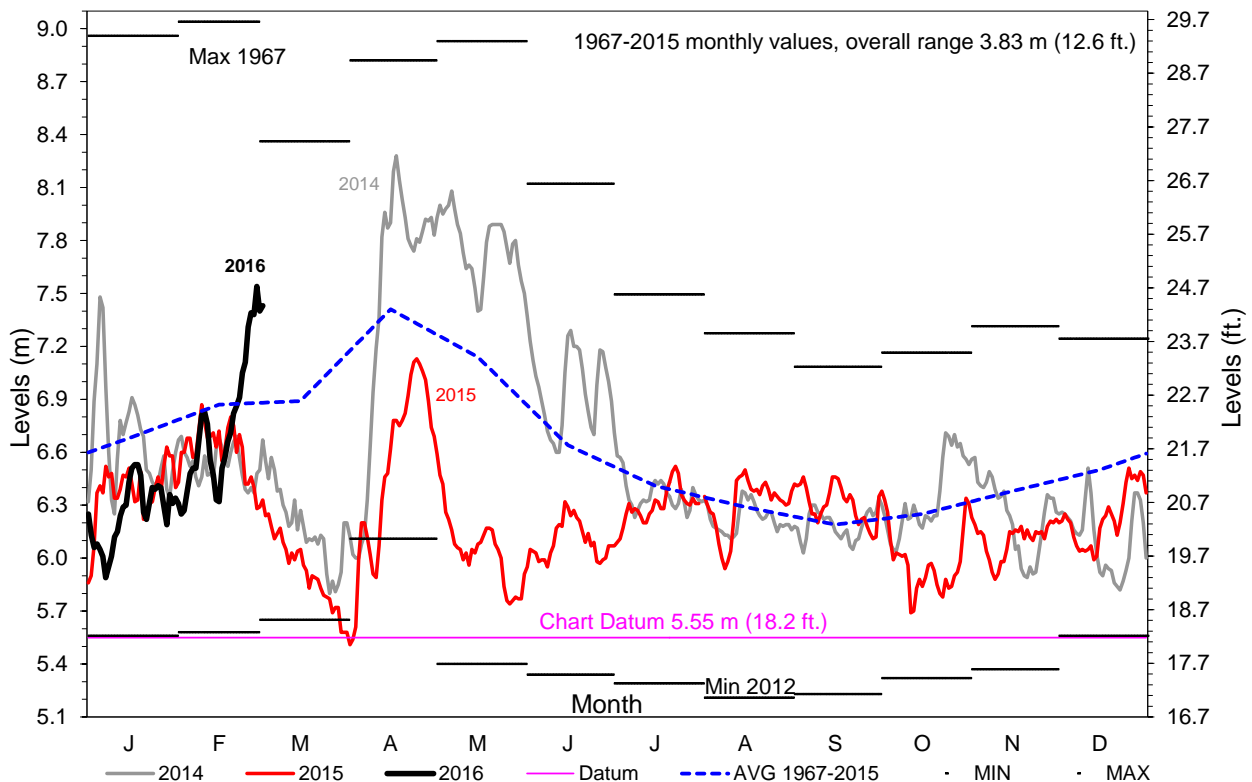


Figure 8: Daily Port of Montreal Levels @ Jetty #1



Appendix A: 2015 Communication Committee Summary

International St. Lawrence River Board of Control Communication Committee 2015 Summary of Activities

Over the course of 2015, the International St. Lawrence River Board of Control (ISLRBC) Communication Committee held 10 meetings, generally occurring each month via teleconference, with two in-person meetings. One major focus throughout the year was the development of the ISLRBC Strategic Communication Plan to meet the International Joint Commission's (IJC) 2015-2020 strategic communication goals.

The committee developed a plan which provides mechanisms to accomplish five strategic communication goals: Increase general public awareness of the IJC and the ISLRBC; communicate accurately and in a timely fashion about the actions of the ISLRBC and the reason for those actions; explain how natural factors and regulation affect water levels and flows; increase understanding of the necessity of and need to prepare for fluctuations in levels and flows; and consistently seek out, consider and respond to the views and concerns of all stakeholders.

The committee successfully gained the approval of the ISLRBC and submitted its plan to the IJC for information. In addition to developing the communication plan, the committee completed many other products and activities consistent with the communication strategy including:

- Created a standard slide presentation covering multiple ISLRBC topics for Board members to use at outreach and speaking engagements.
- Initiated the development of voice-over narration for the seven animated learning modules on the ISLRBC website
- Posted weekly updates on water levels and outflows through the Board's website and Facebook pages
- Responded to numerous public inquiries concerning low water levels on Lake St. Lawrence
- Held two public webinars/teleconferences in March and September
- Created a Flickr account for publically accessible photos with captions
- Posted the Board's semi-annual progress reports, meeting minutes, and media releases to the ISLRBC webpage
- Presented at the 2015 Forum of the Table de Concertation Régionale (TCR) du Lac Saint-Pierre. In Louiseville, Quebec on 29 May 2015
- Presented to the 2015 Association des Biologistes du Québec (ABQ) and le Réseau des organismes de bassins versant du Québec (ROBVO) on 6 November 2015, and the Montreal Field Naturalists on 25 November 2015
- Began data collection for two video segments on the topics of ice formation and fluctuating water levels to be posted on the Board website for public discussion

Finally, due to a lack of public participation, the committee discontinued the Board's 800 number, which reported water levels and flows, and decided to stop holding semi-annual public teleconferences/webinars. The committee, in consultation with the Board and IJC, determined that other methods of communication such as Facebook, YouTube and learning modules, have proved to be more effective forms of communication due to technological advancements and social trends. The Board will continue to consider the option of holding public teleconferences/webinars on an as-needed basis, and has protocol readily available for holding such meetings.

Appendix B: Glossary, Abbreviations, and Background Information

**Appendix to the Progress Reports
to the
International Joint Commission
by the
International St. Lawrence River Board of Control
Covering the Periods After
March 2011**

APPENDIX OBJECTIVE

The objective of this appendix is to provide the background material that was previously presented in the semi-annual reports of the International St. Lawrence River Board of Control (the Board) to the International Joint Commission (the Commission). Providing the material in this manner allows the report to focus on the issues and conditions of the reporting period, and the interested reader to refer to this appendix for the background information.

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1. HYDROLOGICAL CONDITIONS

1.1 Net Basin Supply to Lake Ontario

Lake Ontario is the furthest downstream of the five Great Lakes. It receives the outflow of Lakes Superior, Michigan, Huron and Erie (Figure A-1). Historically, about 80 percent of the water received by Lake Ontario comes from the upstream Great Lakes. Lake Ontario outflows are controlled at a location about 160 kilometres (100 miles) from the Lake (Figure A-2), with almost all of the water going through the Moses-Saunders powerhouse. Prior to construction of the powerhouse and navigation locks (Figure A-3), the flow out of Lake Ontario was controlled by a set of rapids that began about 110 kilometres (70 miles) downstream of the Lake, near the towns of Ogdensburg, New York and Prescott, Ontario.

Water supply to Lake Ontario is composed of four main factors (Figure A-4): inflow from Lake Erie through the Niagara River and Welland Canal diversion, precipitation on the surface of the Lake, runoff from streams and groundwater flowing into the Lake, and evaporation of water from the Lake. In addition, water for consumptive use is taken from the Lake.

In the semi-annual progress reports, supplies to Lake Ontario are reported in terms of Net Basin Supplies and Net Total Supplies. The definitions of these terms are as follows:

The Net Basin Supply is the aggregate of the amount of precipitation over the Lake, runoff to the Lake, including groundwater, and evaporation and consumptive uses from the Lake's surface. Precipitation and runoff are estimated by measurements but it is not possible to accurately measure evaporation and consumptive uses. Therefore, the Net Basin Supply is estimated as the difference between the Lake's outflow down the St. Lawrence River and inflow from Lake Erie, plus any change in storage within the Lake itself as a result of a rise or fall in the Lake's level. An indicator of the amount of spring runoff that may be expected is obtained by monitoring the snow pack in the basin.

The Net Total Supply is obtained by adding to the Net Basin Supply the inflows from Lake Erie through the Niagara River and Welland Canal. The Niagara River flow is computed using a stage-discharge relationship for the Niagara River below Niagara Falls and adding the flow through the hydropower turbines located along the Niagara River.

1.2 Supplies of Lake Ontario

A summary of the mean supplies to Lake Ontario for each month in the reporting period is provided in tabular and graphical form as referenced in the text of Section 1. This information includes the inflow from Lake Erie, net basin supply and total supplies, along with some statistical data to assist in understanding how they compare historically.

Also shown are the long-term average monthly net basin supplies, and supplies for the previous two years. The horizontal bars above and below the plots are the recorded maximum and minimum long-term monthly net basin supplies for the period of record since 1900.

1.3 Precipitation

Monthly precipitation amounts for the Lake Ontario and Great Lakes basins for each reporting period of the semi-annual reports are provided in a table referenced in Section 1 of the report.

1.4 Snow-pack on the Lake Ontario Basin

The snow-pack on the Lake Ontario basin affects spring runoff supplies when the snow melts; however because of limited snowpack data and lack of skill in predicting melt conditions, the volumes of spring runoff are difficult to quantify.

1.5 Lake Ontario – Net Total Supply

The monthly net total supplies (NTS) to the Lake for each reporting period of the semi-annual reports are provided in tabular form (Table 3) and graphical form (Figure 1) showing the long-term average monthly NTS for the period of record and the supplies for the current reporting period. Also shown, for comparison purposes, are the monthly NTS for the previous two years. The horizontal bars above and below the curves on the graph are the long-term monthly net total supplies maxima and minima for the period of record since 1900. Also shown is a table of the six-month net total supplies for the past ten years for comparison purposes.

1.6 Ottawa River Basin

The Ottawa River is a major tributary of the St Lawrence River joining just upstream of Montreal which contributes to the water level of Lake St Louis at Pointe Claire and points downstream in the St. Lawrence River.

2. REGULATION OF FLOWS AND LEVELS

2.1 Application of Regulation Plan 1958-D

The Board assures that the provisions of the Commission's Orders of Approval relating to Lake Ontario-St. Lawrence River outflows and levels are met. Control of the outflows and levels of Lake Ontario follows a regulation plan that was designed to satisfy the criteria set out in the Commission's 1956 Orders and other requirements that were established to balance the benefits of regulation among various interests. The current plan of regulation, Regulation Plan 1958-D, was adopted by the Commission in 1963.

In 1961, the Commission authorized the Board to deviate from the outflows specified by the regulation plan in order to provide additional benefits to interests when this could be done without appreciable adverse effects on other interests. Today, the Board reviews conditions in the Great Lakes and Lake Ontario-St. Lawrence River basins at least monthly and establishes outflow strategies for the coming weeks that may or may not include deviations from Plan flows.

The outflow from Lake Ontario is computed weekly by following the procedure laid out in the Board's July 1963 Report to the Commission on Regulation Plan 1958-D. The computational procedure includes the following steps (the reader is referred to the Board's 1963 Report for additional details and considerations):

- Calculation of a provisional flow based on present conditions in the system (e.g., recent supplies and current/computed levels);
- Checking the provisional outflow against operational limits designed to protect interests; and,
- Setting a final 'Plan' outflow.

The Plan outflow is then reviewed by the Board's Regulation Representatives and Operations Advisory Group (OAG), and assessed against the Board's current outflow strategy and the current operational requirements of domestic water supply, navigation, power and other interests in the

system. If all are in agreement, the Regulation Representatives, on behalf of the Board, recommend an outflow for the coming week to the Government representatives who direct the hydropower entities (who operate the structures that control the outflows) on the outflow. If not all OAG members and Regulation Representatives agree on the flow for the coming week, the Board of Control is called upon to decide.

To aid in decision making, the Board analyses the risk of exceeding the criteria of the Orders and other water level indicators developed by the Board through experience.

2.2 Board Regulation Strategies and Actions

In order to be responsive to changing conditions and the needs of various interests, the Board schedules monthly teleconferences to review conditions in the Great Lakes-St. Lawrence River system and develop outflow strategies to respond to conditions and ensure that the Board is able to offer assistance to interests in times of critical need. The outflow strategies are designed to enhance the benefits provided by Regulation Plan 1958-D while not causing appreciable adverse effects to any interest. The Board Members are provided an assessment of conditions at the beginning of each month. Based on that, and a recommendation from the Regulation Representatives, the Board may decide that the strategy currently in place does not need to be modified. In such cases, a conference call may not be held. The strategy decisions made during the reporting period, and their rationales, are available on the Board's Website: http://ijc.org/conseil_board/islrbc/en/main_accueil.htm.

Figures referenced in Section 2 of each semi-annual report show the daily Lake Ontario outflows during the reporting period, and the Lake Ontario actual daily and weekly computed Plan 1958-D and pre-project condition levels during the reporting period. The Board's deviations from Plan 1958-D during the reporting period are summarized in tabular form as referenced in this section.

2.3 Ice Management

The hydropower entities install a series of ice booms each winter in the international section of the river to aid in the formation and stabilization of the ice cover. Hydro Quebec also installs a series of ice booms in the Beauharnois Canal each year. The Board does not direct the installation or removal of any of these booms. Installation and removal of the booms is coordinated between the hydropower entities and the St. Lawrence Seaway. The booms are normally removed as the ice deteriorates locally.

2.4 Iroquois Dam Operations

Under the conditions of paragraph (j) of the Commission's Order of Approval dated 29 October 1952, the power entities are permitted to operate Iroquois Dam with Board approval. The gates of the dam can be lowered into the water to assist in ice formation and to reduce the level of Lake St. Lawrence when there are low outflows. Boaters must use the Iroquois lock to bypass the dam when the dam gates are in use.

2.5 Results of Regulation

2.5.1 Upstream

Lake Ontario

The effects of Regulation Plan 1958-D and the Board's outflow strategies on the daily water levels on Lake Ontario for the previous two years and the current year to date are shown in

Figure 3 of each of the semi-annual reports. As a means of informing the Commission on the impacts of regulation activities on levels and outflows, the Board provides the Commission with a comparison of Lake Ontario's actual monthly levels and outflows to those that would have been obtained under pre-project conditions (that is, the levels and outflows that would have occurred had regulation not been undertaken). A summary of this comparison for the reporting period is provided in a table referenced in this section of the report. The referenced figure provides a comparison of the daily levels to long-term average, and the levels of the previous two years.

Lake St. Lawrence

The period of record for this water level gauge is from 1960.

2.5.2 Downstream

Lake St. Francis at Summerstown

The regulation of Lake Ontario outflows has a limited effect on the levels of Lake St. Francis, as the lake level is regulated by hydropower plant operations at Beauharnois and Les Cèdres, Québec. The historic range of monthly mean levels on Lake St. Francis since completion of the Saunders-Moses project is about one-fifth that of Lake St. Lawrence. The water levels of Lake St. Francis are shown in a figure referenced in Section 2 of each of the semi-annual reports. The period of record for this water level gauge is from 1960.

Lake St. Louis at Pointe Claire

Lake St. Louis water levels, in contrast, are influenced by the discharges from both the St. Lawrence and Ottawa Rivers, and are subject to much greater fluctuations. The period of record for this water level gauge is also from 1960.

Port of Montreal

Water level fluctuations in Montreal Harbour are influenced by the discharges from the St. Lawrence and Ottawa Rivers, winds, the tide, and in winter, by downstream ice conditions. The water levels of the harbour are shown in a figure referenced in Section 2 of each of the semi-annual reports. The period of record for this water level gauge is from 1967. Water level data prior to 1967 are not used to compute the averages or extremes as the St. Lawrence River near and below Montreal was altered by a dredging project in 1967.

3. BOARD ACTIVITIES

3.1 Board Meetings & Conference Calls

The Board, as mentioned in the previous section, oversees the operations of the hydropower project in the international reach of the St. Lawrence River. The Board, primarily through the offices of the Regulation Representatives, monitors conditions throughout the Lake Ontario-St. Lawrence River and Ottawa River systems. The Regulation Representatives provide the Board with weekly regulation data, monthly reviews of hydrological conditions, monthly risk analyses using water level outlooks, and advises the Board on regulation strategy options and their potential impacts on water levels and interests throughout the system. The Board's Operations Advisory Group (OAG) holds weekly teleconferences to apprise the Regulation Representatives of operational requirements and constraints. The Committee on River Gauging monitors the

Power Entities' program for operation and maintenance of the gauging system required for Board operations, and reports to the Board annually.

The Board typically assesses conditions on a monthly basis in the basin and adjusts its regulation strategy through meetings, conference calls, telephone and e-mail. Should conditions change rapidly, the Board can (and has) met more often. Board Members in attendance at these meetings and teleconferences are noted in a table referenced in this section.

3.2 Public Outreach and Engagement

Since 2015 the Board uses social media such as Facebook to interact with the public in lieu of regularly scheduled public webinars. The Board still maintains the option of holding public meetings, but will do so on an as-needed basis. The Communications Committee, individual Board Members and the Secretaries actively engage in outreach, information exchange and liaison with stakeholders throughout the Lake Ontario-St. Lawrence River system. Board members and staff respond to a number of inquiries and requests for interviews from the media and general public concerning water level conditions and the Board's strategies. These are detailed in each semi-annual report to the Commission.

4. COMMUNICATIONS COMMITTEE

The Board's experience and work under the IJC's Lake Ontario - St. Lawrence River Study both demonstrate that communications have become ever more important to the Board and Commission. Therefore, effective communications remains a key focus of the Board. Each semi-annual report summarizes the Board's communications activities during the reporting period. To lead this effort, the Board has a standing committee (the Communications Committee), consisting of two Board Members, the Board Secretaries, the Public Information Officers of the Commission, and the Engineer Advisors of the Commission.

5. RIVER GAUGING COMMITTEE REPORT

The Board's St. Lawrence Committee on River Gauging monitors the Power Entities' program of operating and maintaining 15 water level gauges required for the Board to monitor water levels and flows related to the operation of structures and forebay elevations. The Committee members are the U.S. Regulation Representative (U.S. Co-chair), a representative from Ontario Power Generation (Canadian Co-chair), a representative from the New York Power Authority and the Canadian Regulation Representative. Committee associates perform annual inspections of the water level gauging network.

The Committee thus ensures the accuracy of flow and water level measurements. This includes annual inspections of the computational methods used at each of the eight outflow structures as well as auditing the Power Entities' data processing. The Committee is charged with providing the Board with an annual report on the inspection results and computed outflows. Each semi-annual report records the status of the River Gauging Committee annual reports and any recent issues.

#. RAISIN RIVER DIVERSION

The Raisin River diversion is located at the village of Long Sault, ON. It is operated by the Raisin Region Conservation Authority to augment flow in the upper reaches of this small river, as necessary. The purpose of this diversion is to augment low summer flows in the Raisin River

to provide a reliable source of water for farms and villages, and to improve the environment for fish and wildlife, as well as recreational uses.

6. ST. LAWRENCE SEAWAY REPORT

Each semi-annual report records the first or last ship of the recording period.

7. HYDROPOWER PEAKING AND PONDING

By letter dated 13 October 1983, the Commission authorized Ontario Power Generation and the New York Power Authority to continue to carry out peaking and ponding operations at the St. Lawrence Project. Conditions governing peaking and ponding operations are specified in Addendum No. 3 to the Operational Guides for Regulation Plan 1958-D. The authority to peak and pond had been subject to Commission review and approval every five years. However, on 28 October 2005, the Commission approved peaking and ponding operations until the adoption of any revised Orders for the regulation of the St. Lawrence River or a period shorter than five years.

The semi-annual reports record peaking and ponding activities which occurred during the reporting period.

8. BOARD AND COMMITTEE MEMBERSHIP CHANGES

Each semi-annual report records changes in membership of the Board, its Regulation Representatives, Secretaries, Gauging Committee, and Operations Advisory Group.

9. ABBREVIATIONS AND TERMS USED IN THIS REPORT

actual (data)	the actual recorded value
avg	average
Board	International St. Lawrence River Board of Control (unless otherwise specified)
cfs	cubic feet per second
cm	centimetre(s)
cms	cubic metres per second
Commission	International Joint Commission
computed level, outflow	the level or outflow computed by Regulation Plan 1958-D
deviation (outflow)	a Lake Ontario outflow different from the Plan 1958-D outflow
exceedence probability	the percent of time that the value was exceeded in the past
ft	foot/feet
IJC	International Joint Commission
ISLRBC	International St. Lawrence River Board of Control
in	inch(es)
Lake	Lake Ontario (unless otherwise specified)

level	water level
LTA	long-term average
m	metres
m ³ /s	cubic metres per second
mm	millimetres
NYPA	New York Power Authority
OAG	the Board's Operations Advisory Group
OPG	Ontario Power Generation
Peaking Plan	hour-to-hour flow changes over the course of a day Regulation Plan 1958-D
Ponding pre-project	day-to-day flow changes over the course of a week the levels and outflows that would have occurred had regulation not been undertaken
regulation	management of levels and flows in the Lake Ontario-St. Lawrence River system by physical control of outflows from Lake Ontario
Regulation Plan 1958-D	current plan of regulation for Lake Ontario
Seaway Study Board	the St. Lawrence Seaway (commercial navigation facility) International Lake Ontario-St. Lawrence River Study Board
supply	quantity of water received
tcfs	thousand cubic feet per second

Figure A-1. Great Lakes Drainage Basin - St. Lawrence River System

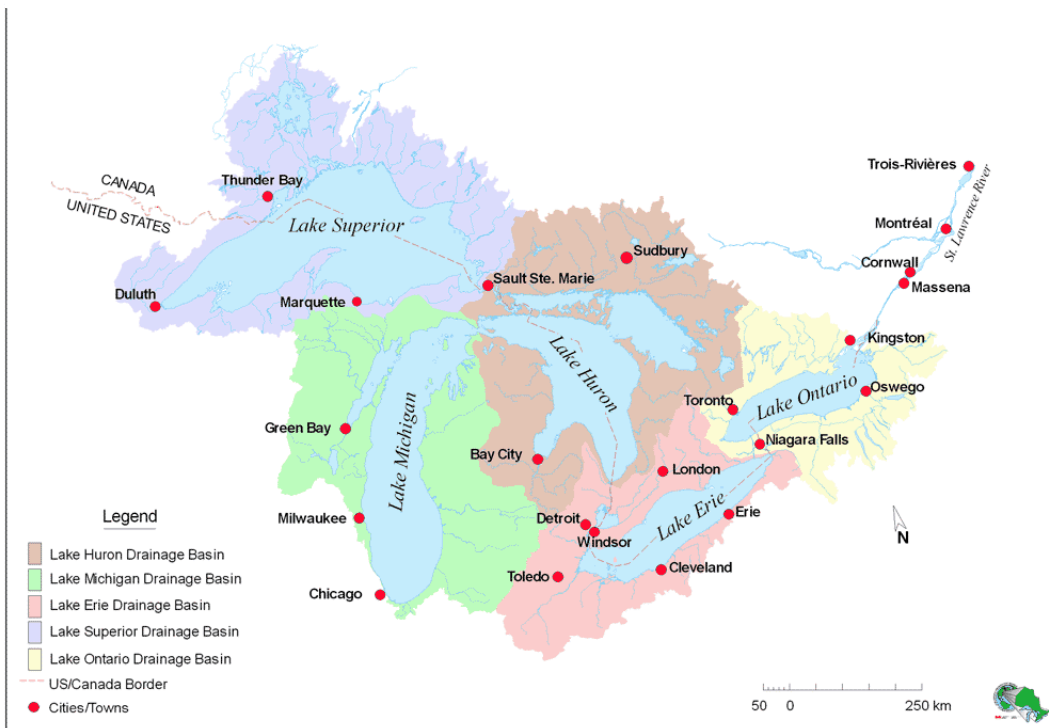


Figure A-2. Map of Lake Ontario-St. Lawrence River System

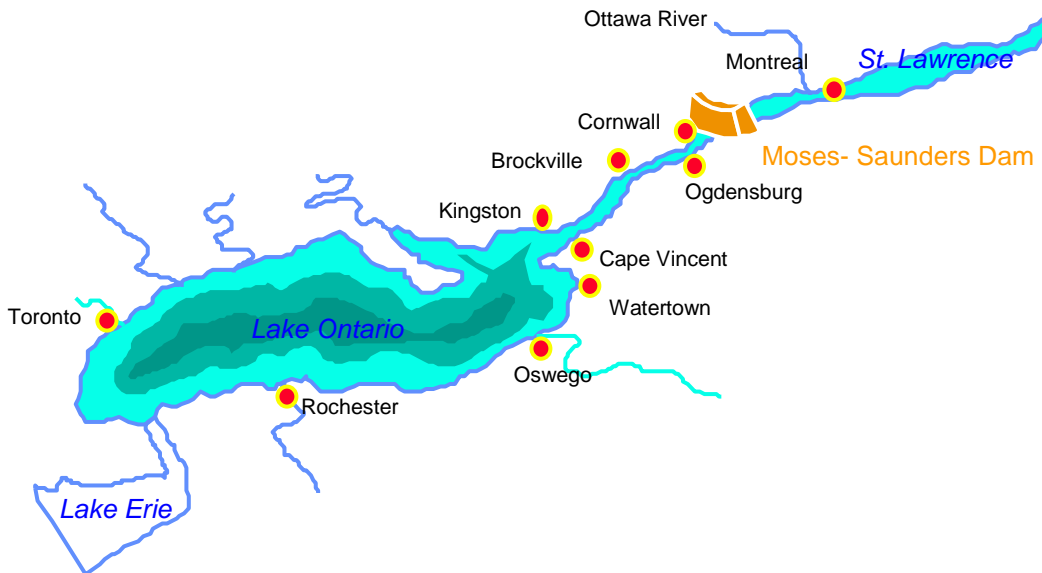


Figure A-3. Map of Upper St. Lawrence River Control Structures

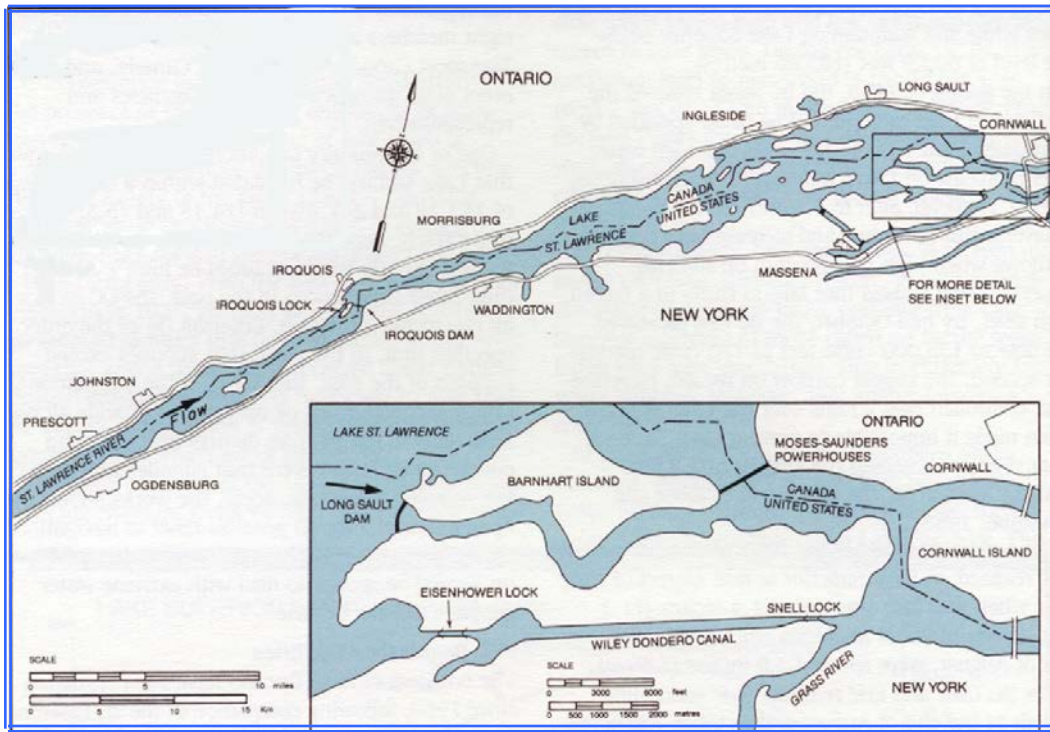
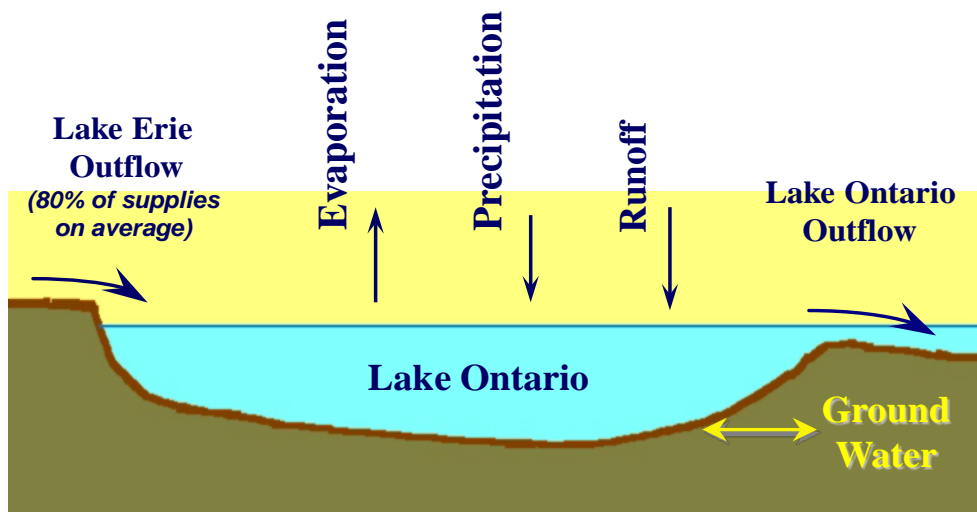


Figure A-4. Factors Affecting the Level of Lake Ontario



Appendix C: GLAM Annual Work Plan and Communication Strategy

Great Lakes-St. Lawrence River
Adaptive Management Committee

GLAM

Annual
Work
Plan

Fiscal Year

2016

First Annual Work Plan towards building a long-term vision and adaptive management strategy for the on-going review and evaluation of the regulation plans.

Covering
October 1, 2015 to
September 30,
2016

DRAFT

September 16, 2015

Communication Management Strategy

Project Name:	Communications, Outreach and Engagement Strategy		
Date:	August 2015	Release:	<u>Draft</u>
Author:	Great Lakes-St. Lawrence River Adaptive Management (GLAM) Committee		
Owner:	GLAM Committee		
Client:	International Joint Commission and Great Lakes St. Lawrence River Boards of Control		
Document Number:	GLAMC-COM-1		

Communication Management Strategy

Introduction

The Great Lakes – St. Lawrence River Adaptive Management Committee (GLAM) was established to undertake the monitoring, modelling and assessment related to the on-going evaluation of the water level regulation plans and address other questions that may arise due to changing conditions in consultation with the International Lake Superior, Niagara, and St. Lawrence River Boards of Control. Specific tasks include:

- Develop an open and collaborative process for updating models and incorporating new science.
- Provide semi-annual updates to the Boards in advance of the IJC semi-annual appearances.
- Prepare a report on the progress of the work plan, providing advice to the Commission regarding adaptive management. This report will be coordinated with the preparation of the Commissions triennial “Assessment of Progress Report” under the Great Lakes Water Quality Agreement.
- Not more than 15 years after the establishment of the GLAM, provide a synthesis of the collective public and peer reviewed science and information gained from tasks outlined in the work plan and prepare formal recommendation to the Boards of any changes that may be warranted.

The GLAM Committee will require communication with and the engagement of a range of stakeholders, agencies and academia to maintain awareness of the diverse and potentially changing needs of the various interests, and to ensure an open and transparent science based adaptive management process.

Purpose

To establish a framework that guides all GLAM Committee communications. This strategy is to provide structure for facilitating outgoing and incoming communication between the GLAM Committee and the International Joint Commission (IJC), Boards of Control, governmental and non-governmental agencies/organizations, stakeholders, members of the public, and academic/research community to best serve the ultimate goal of the GLAM Committee, which is to learn how best to manage water levels and flows to respond to new knowledge and changing conditions.

Objectives

1. Clarify the roles of, and interactions among the GLAM Committee, the Boards of Control and the IJC in their communications activities.
2. Engage, listen and work with key stakeholders and interests who are willing to contribute to increasing the understanding of the effects of water levels and flows and changes over time.
3. Encourage scientific research, monitoring programs, and information management systems that may be beneficial to the GLAM Committee.
4. Support the IJC with coordination between the Great Lakes control boards and the Great Lakes Water Quality Board (WQB) and Science Advisory Board (SAB).
5. Publicize a working example of adaptive management to improve the practice of adaptive management.

Communication Management Strategy

Communication Principles

1. The GLAM Committee's external communications will be effectively coordinated with the Lake Superior, Niagara and St. Lawrence Boards of Control and IJC Communications. GLAM Committee public announcements and interactions will typically be made through the Boards or IJC and/or with full endorsement by the Boards and IJC.
2. However, the GLAM Committee may engage in external communication directly with specific audiences to facilitate research, seek stakeholder input, provide information regarding general adaptive management principles, and identify funding opportunities.
3. The GLAM Committee's internal communications will adhere to the IJC communication principles.
4. While the focus of GLAM communications will be to maintain the on-going evaluation and assessment of lake level regulation plans, communications activities will also support the principle of adaptive management¹. These activities will inform those who are more interested in adaptive management than lake regulation

Communications Procedure

The GLAM committee will require communication, outreach, and engagement to fulfil its diverse objectives. First, "communication" will be required to report on activities and convey key messages to the Boards of Control, the IJC and for public consumption. Second, the GLAM will require "outreach" so the committee can maintain awareness of outside efforts from government and non-government agencies, organizations, researchers/academia, and stakeholders that may support AM efforts. Lastly, the GLAM will require "engagement" to facilitate collaboration and coordination among relevant parties that may support AM activities. Table 1 provides a list of tasks in the areas of communication, outreach, and engagement that will support each of these efforts.

Products and Tactics

- Key messages
- Fact sheets
- Standard presentations
- GLAM web site content
- Media lines
- Attendance and participation at stakeholder meetings, conferences, conventions,
- Stakeholder circles of influence meetings, webinars and teleconferences
- An agency advisory committee/network of key agencies and organizations committed to adaptive management with whom the GLAM can regularly engage
- Utilize existing Great Lakes research networks to communicate research opportunities that would support AM
- Utilize existing Great Lakes communications networks (e.g. Sea Grants and Conservation Authorities) for distributing key messages

¹ Years of discussion on the IUGLS study were required to affirm, then propose, adaptive management. Adaptive management is still difficult to fund. If the Committee is able to demonstrate that the approach is practical and effective, the value of adaptive management would gain greater recognition.

Communication Management Strategy

Key Messages

- The purpose of Adaptive management (AM) is to establish a structured, iterative process of robust evaluation in the face of uncertainty, with an aim to reduce uncertainty over time via system monitoring and feedback to the decision framework based on knowledge gained.
- The Great Lakes are dynamic and conditions, such as climate, are always changing
- There remains considerable uncertainty in our understanding of the implications of climate change and water level extremes, and how they may impact the regulation of outflows on the Great Lakes-St. Lawrence River system
- New regulation plans have been implemented or recommended and it is important to ensure their intended objectives are being met, now and into the future
- Adaptive Management is intensively collaborative and based on working with partners in the Great Lakes-St. Lawrence River system to gather and share critical information over time, assess the information with state-of-the art tools, measure our collective success in managing the impacts of water levels and adapt regulation plans accordingly over time.

Key Stakeholders

See table 2: Stakeholder Analysis

Records

- Meeting minutes will be provided by the secretaries and stored on the GLAM SharePoint site and posted to the GLAM Committee website for public view.
- Records of stakeholder meetings/workshops will be provided by the secretaries, reviewed by the stakeholders and stored on the GLAM SharePoint site and posted to the GLAM Committee website.

Reporting

- Semi-annual report to the Boards of Control on the GLAM work plan.
- Annual work plans to be submitted in September and progress reports in April.
- Triennial report on the evaluation of regulation plans on stakeholders and the GLAM work plan to the IJC Not more than 15 years after the establishment of the GLAM, provide a synthesis of the collective public and peer reviewed science and information gained from tasks outlined in the work plan and prepare formal recommendation to the Boards of any changes that may be warranted.

Communication Management Strategy

Table 1: Communication Procedure

	Communication Procedure	Tools and Techniques	Resource Needs	Target Audience
COMMUNICATION	Develop communication templates consistent with IJC protocols	Templates for presentations, written correspondence	GLAM Committee member time	IJC, Boards
	Establish working relationships with the three Boards of Control and coordinate a general broadcast strategy with them	GLAM Committee to be represented at all Board meetings	GLAM Committee member time	Boards
	Develop a story line of the evolution of the GLAM	Develop a standard presentation/fact sheet on what GLAM is for distribution and posting to GLAMC website	GLAM Committee member time	All
	Inform interested parties on AM concept, role of GLAM, the need for collaboration, and specific messages for target audiences	Key messages, fact sheets, standard presentation for use at conferences, meetings etc.	GLAM Committee member time	All
	Create a mechanism for posting and distributing regular bulletins about GLAM work	GLAM website, email distribution list, GLIN announce, social media – coordinate through Boards	GLAM Committee member time	All

Communication Management Strategy

	Communication Procedure	Tools and Techniques	Resource Needs	Target Audience
	Create a media strategy particularly around special events and triennial reports	Develop approved media lines, appoint spokespersons from Board, IJC and GLAM Committee, develop briefing kits	IJC Communications	Media/public
OUTREACH	Establish a research community network. Develop a list of research opportunities that support AM efforts	Standard presentation, attendance at relevant conferences (IAGLR,..., email distribution list	GLAM Committee member time , travel funds	Academia and Research Community
	Create a research outreach plan that covers both the monitoring of scientific literature on related subjects and a GLAM to agency connection that promotes research to address GLAM objectives	Research reviews; input from Great Lakes Science organizations; linkages with other Great Lakes wide initiatives (e.g. GLWQA; Blue Accounting; Great Lakes research consortiums etc.)	GLAM Committee member time	Academia and Research Community
	Link with other key agency priorities (e.g. CSME for LaMPs , SOLEC indicators, IJC indicators, and GLWQA Annexes	GLAM representation at meetings, conferences, teleconferences	Travel funds, conference registration, GLAM Committee member time	Government agencies

Communication Management Strategy

	Communication Procedure	Tools and Techniques	Resource Needs	Target Audience
ENGAGEMENT	Solicit stakeholder input on current or future models, indicators, and or plan performance	Develop circles of influence strategy with stakeholders from the six sectors including meetings, webinars, teleconference, and emails	GLAM Committee member time, travel funds	Stakeholders
	Engage with agency senior management to encourage collaboration and sharing and exchanging information with other related programs	Regularly scheduled meetings, webinars, and/or emails	GLAM Committee member time, travel funds	Government agencies
	Network with other efforts on the Great Lakes to share and exchange information and join activities	Conferences, workshops, webinars	Travel funds, conference registration, GLAM Committee member time	NGOs, government agencies

Communication Management Strategy

Table 2: Stakeholder Analysis

Interested Party²	Sub-group	Priority	Current Relationship	Objective (Desired Relationship)	Interfaces
International Joint Commission	Advisors	To be completed	To be completed	To be completed	To be completed
St. Lawrence River Board of Control	Secretaries Communications Group Board members	To be completed	To be completed	To be completed	To be completed
Niagara River Board of Control	Secretaries Board members	To be completed	To be completed	To be completed	To be completed
Lake Superior Board of Control	Secretaries Board members	To be completed	To be completed	To be completed	To be completed
Agency Senior Management	USACE; NOAA-GLERL; USGS; EPA; EC; DFO; TC NRCan; MNRF MOE&CC; CO; State DECs; GSLCI; GLC; CGLG; GLFC; MDDEFP;	To be completed	To be completed	To be completed	To be completed

² This may include accounts staff, user forum, internal audit, corporate or programme quality assurance, competitors etc.

Communication Management Strategy

Interested Party ²	Sub-group	Priority	Current Relationship	Objective (Desired Relationship)	Interfaces
Research Groups (NGOs, Academia, Great Lakes groups)	Graham Institute – Water Center;	To be completed	To be completed	To be completed	To be completed
Water Quality Group	GLWQA Annex 2; Annex 4, Annex 9; WQB; SAB-SPC	To be completed	To be completed	To be completed	To be completed
Existing Great Lakes Networks/Communication Organizations	SeaGrants, RUSL, LORA, GBA, CAs; OCCIAR, GLIN; GLEC; LAMPS; ROW; CGL; GLSLCI etc.	To be completed	To be completed	To be completed	To be completed
Coastal Riparian Groups	CAs; ; Association of State Floodplain Managers; FEMA; State Coastal Managers; GLSLCI; Coastal researchers; LORA; GBA; various property owner associations; International Great Lakes Coalition	To be completed	To be completed	To be completed	To be completed
Commercial Navigation	St. Lawrence Seaway (US and CAN); Port				

Communication Management Strategy

Interested Party ²	Sub-group	Priority	Current Relationship	Objective (Desired Relationship)	Interfaces
	Authorities (Montreal, major lake ports like Duluth, Hamilton, etc.); FedNav USACE group; Lake Carriers Association; Coast Guard; Transport Canada,				
Ecosystem Interests	TNC; CAs; GLRI; LAMPS; EC; St Lawrence Institute; DFO; Bird Studies Canada; Ontario Field Ornithologists, NY State Ornithological Association, local birding clubs, Ontario MNR, NYSDEC, Great Lakes Fishery Commission, St. Marys River	To be completed	To be completed	To be completed	To be completed

Communication Management Strategy

Interested Party ²	Sub-group	Priority	Current Relationship	Objective (Desired Relationship)	Interfaces
	Fisheries Task Group				
Hydropower Production	OPG and NYPA (Niagara), Hydro Quebec (St. Lawrence), Brookfield, Cloverland (Superior), Welland Canal (Seaway), Parks Canada Lock at Soo	To be completed	To be completed	To be completed	To be completed
Recreational Boating and Fishing	Marina associations; tour, cruise and ferry operators; boating associations; riparian owners; boating shows; MNR&F;	To be completed	To be completed	To be completed	To be completed
Municipal and Industrial Water Use Industry	City water	To be completed	To be completed	To be completed	To be completed

Acronyms

AM – Adaptive Management

Communication Management Strategy

CA – Conservation Authority
CCGLBHHD – Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data
CGLG – Council of Great Lakes Governors
CO – Conservation Ontario
DFO – Fisheries and Oceans Canada
EC – Environment Canada
EPA – U.S. Environmental Protection Agency
FEMA – Federal Emergency Management Agency
GBA – Georgian Bay Association
GLC – Great Lakes Commission
GLEC - Great Lakes Executive Committee
GLERL – Great Lakes Environmental Research Laboratory
GLFC – Great Lakes Fishery Commission
GLIN – Great Lakes Information Network
GLOS - Great Lakes Observing System
GLRI – Great Lakes Restoration Initiative
GLRPB – Great Lakes Regional Planning Body
GLSLCI – Great Lakes and St. Lawrence Cities Initiative
GLWQA - Great Lakes Water Quality Agreement
IJC – International Joint Commission
IUGLS – International Upper Great Lakes Study
LAMPs – Lakewide Action and Management Plans
LORA – Lake Ontario Riparian Alliance
LOSLR – Lake Ontario St. Lawrence River Study
MDDEFP – Ministry of Sustainable Development, Environment, Wildlife and Parks (Quebec)
MOE&CC – Ministry of Environment and Climate Change (Ontario)
MNRF – Ministry of Natural Resources and Forestry (Ontario)
NARRCAP – The North American Regional Climate Change Assessment Program
NGOs – Non-Governmental Organizations
NOAA – National Oceanic and Atmospheric Administration
NOPLRPB – National Ocean Policy Great Lakes Regional Planning Body
NRCan – Natural Resources Canada
NYDEC - New York State Department of Environmental Conservation

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NYPA – New York Power Authority

OCCAIR – Ontario Center for Climate Impacts and Adaptation Resources

OPG – Ontario Power Generation

Ouranos – A consortium on regional climatology and adaptation to climate change

SAB – RCC – Science Advisory Board – Research Coordination Committee

SAB – SPC – Science Advisory Board – Science Priorities Committee

SLAP – St. Lawrence Action Plan

TC – Transport Canada

TNC – The Nature Conservancy

USACE – U.S. Army Corps of Engineers

USFWS – U.S. Fish and Wildlife Service

USGS – U.S. Geological Survey

WQB – Water Quality Board (IJC)

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Created/updated 28/03/16

DRAFT WORK PLAN

Project Name:	Great Lakes-St. Lawrence River Adaptive Management (GLAM) Committee Annual Work Plan for 2016		
Date:	Sept. 16, 2015	Release:	<u>Draft 3</u>
Author(s):	Wendy Leger, Mike Shantz, Jacob Bruxer, John Allis, Bill Werick, Arun Heer, Kyle McCune		
Owner:	GLAM Committee		
Client:	Great Lakes St. Lawrence River Boards of Control and International Joint Commission		
Document Number:	GLAMC-WP-1		

Note: This document is only valid on the day it was printed

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Created/updated 28/03/16

Overview

Purpose The work plan provides a statement of how and when objectives of the GLAM Committee are to be achieved, by showing the major products, activities and resources required for the scope of the plan. This first work plan includes the priority activities to be carried out by the GLAM Committee in the first year covering Oct 1/15 through Sept 30/16 toward building their long-term vision and work plan for the on-going review and evaluation of the regulation plans.

Contents *The Work Plan covers the following topics.*

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The following quality criteria have been observed in developing this work plan:

- The work plan is achievable
- Estimates are based on consultation with the resources who will undertake the work, and/or historical data
- Team leads agree that their part of the plan is achievable
- It is planned to an appropriate level of detail (not too much, not too little)
- The work plan incorporates lessons from previous IJC studies
- The Plan covers management and control activities (such as quality and communication) as well as the activities to create the products necessary to meet the IJC Directive
- The plan supports the GLAM Committee project management strategies including the Communication, Outreach and Engagement Strategy

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Introduction

On January 16, 2015 the International Joint Commission issued a Directive establishing the Great Lakes-St. Lawrence River Adaptive Management (GLAM) Committee to report to the three Great Lakes-St. Lawrence River boards of control (Superior, Niagara and St. Lawrence (Boards)). The GLAM Committee is to undertake the required monitoring, modelling and assessment related to the on-going evaluation of the regulation plans and address other questions that may arise due to changing conditions in consultation with the Boards.

Purpose and Objectives

The general purpose behind adaptive management (AM) is to establish a structured, iterative process of robust evaluation in the face of uncertainty, with an aim to reducing uncertainty over time via system monitoring and feedback to the decision framework based on knowledge gained. In this context the overall objective of the GLAM Committee is to provide information to the Boards and advise them and the IJC regarding the effects that the control structures approved in the Commission's Orders of Approval and Directives have on levels and flows in boundary waters and the impacts the regulation plans have on the affected interests. This includes the on-going review and evaluation of regulation plans related to:

- a) the effectiveness of the existing regulation plans in managing water levels and flows in the Lake Ontario-St. Lawrence River system and the outflows of Lake Superior in the past and into the future;
- b) examining how the system may be changing over time and whether any modifications to the regulation plan(s) may be warranted to address what is learned over time including emerging issues and/or to address changing conditions; and
- c) any other questions requested by the Boards and/or IJC that may affect the Boards' water management decisions over the long-term.

The Directive to the GLAM Committee is to design a work plan that assists the Boards by addressing these questions:

1. How well are the impacts of levels and flows represented by current data and models used in the evaluation of the management of levels and flows?
2. Will future water supplies be different from those used to test the current management of levels and flows; and
3. How are other physical, chemical, biological, and/or socio-economic conditions of the system changing over time?
4. How can the management of levels and flows benefit other physical, chemical, biological and/or socio-economic conditions?

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The focus of this work plan will be to provide a framework that guides all GLAM Committee regulation plan evaluations, clarifies products and annual priorities; identifies roles and responsibilities and annual resource requirements.

Scope and Timeline

The GLAM Committee's work covers the entire Great Lakes-St. Lawrence River system from Lake Superior through to Trois Rivières on the St. Lawrence River. The Work Plan covers the products necessary to meet the IJC Directive as well as management and control activities (such as quality and communication) to ensure an effective adaptive management process. The work of the GLAM Committee is an on-going, long-term effort however, there are timelines that must be adhered to as follows:

- Annually, the GLAM Committee will produce an updated work plan for approval by the Boards and IJC.
- Semi-annually the GLAM Committee will report on progress in fulfilling the work plan to the Boards and IJC.
- Once every three years, the GLAM Committee in consultation with the Boards will prepare a comprehensive progress report to the IJC timed to inform the Commissions' Triennial Assessment of Progress (First one in January 2017).
- As directed by the Commission, and not more than 15 years after the establishment of the GLAM Committee, the Committee will facilitate comprehensive reviews and evaluation of the regulation plans by the Boards based on the available data and information garnered over the review period.

This work plan coincides with the U.S. fiscal year and covers October 1, 2015 through September 30, 2016. It outlines activities to be carried out within that timeline by the GLAM Committee recognizing the short-term requirements of the Committee, but also supporting efforts towards the long-term commitments. This first fiscal year focusses on some immediate priority tasks that will help to address some outstanding questions and lessons learned from the most recent IJC studies (Lake Ontario-St. Lawrence River Study (LOSLR) and the International Upper Great Lakes Study (IUGLS)) as well as priorities for establishing the longer-term evaluation process.

Year 1 Work Plan - Product Descriptions, Timelines and Resources

The adaptive management process is an on-going effort that recognizes the dynamics of the system. This work plan, while based in the context of a long-term initiative and the 15 year reporting period, represents a summary of priority adaptive management products and tasks to be initiated within the first year of the GLAM Committee reporting to the Boards of Control and covering Oct. 1, 2015 through Sept. 30, 2016. The Work Plan is divided into three sections. **Section A** identifies work projects

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organized around the four questions in the GLAM Directive from the IJC. **Section B** includes administrative work needed to manage the GLAM Committee and support all work projects. **Section C** is empty for now, but will be used retrospectively and in future years' work plans for any special projects the Boards may ask the GLAM Committee to pursue.

The items chosen represent activities the GLAM Committee has identified as priorities and which the GLAM Committee believe can be resourced with available staff and funds and completed within the fiscal year. A few additional items are included that the GLAM Committee hopes to accomplish if it can secure some additional funding, maybe through fall submissions to the International Watershed Initiative (IWI) or through additional agency support. There are also a number of additional items included in Appendix 1 that the GLAM Committee considered for this work plan, but these activities go beyond the resources currently available to the Committee and are not expected to be accomplished this fiscal year. In addition to this 2016 Work Plan, a mid-term strategic plan covering the next three to five years will be produced to provide a broader perspective on the work to be completed, and the development of that will be a task within this annual work plan. Items identified that cannot be completed this fiscal year will be added to the mid-term strategic plan. Resources available this fiscal year are identified in the Table below.

Available Resources for FY 2016

The following resources have been identified as available to the GLAM Committee in FY 2016. These resources have been divided amongst all of the tasks and an estimated breakdown is provided in the work plan table at the end of this section.

Agency	Human Resources (Person Years)	Funding U.S. (\$K U.S.)	Funding Canada (\$K Cdn)
IWI Funding		\$45K	\$80K
IJC	0.2	\$5K	\$90K
Environment Canada	3		
Fisheries and Oceans Canada	TBD		
Ontario Ministry of Natural Resources and Forestry	0.5		\$40K
Ministère du Développement durable de l'Environnement et Lutte contre les changement climatiques	TBD		
USACE	3		
NOAA	TBD		
U.S. EPA	TBD		
NYDEC	TBD		
Non-agency GLAM Committee support	0.25		
Total:	6.75	\$50	\$210

Section A - On-going Evaluation of Regulation Plans

The GLAM Committee uses the word “evaluation” in three distinct contexts. The first is consistent with the way it is used in water resources planning and was used during LOSLR and IUGLS, to mean the evaluation of alternative lake level regulation plans using a wide array of performance indicators. The GLAM Committee expects to evaluate alternatives to the current regulation plans eventually, using water levels simulated according to each plan ruleset and approximately century long historic and stochastic net basin supply datasets.

The GLAM must also consider whether the methods and models used to evaluate regulation plans are an adequate representation of reality. So, the second use of “evaluation” is the evaluation of the models used in the plan evaluations; i.e. model validation. For example, this year, GLAM will try to validate the wetland and shore protection damage models used to evaluate LOSLR regulation plans. GLAM will use actual water levels and flows for these evaluations with data series length tailored to the particular performance indicator and monitored data.

Finally, the word “evaluation” is used in answering the question, is the regulation plan in use working out as expected? The operation of Lake Superior Plan 2012 has shown, for example, that it can be better to make the plan release through multiple partially open gates rather than through a fully opened single gate. At the same time, the actual flow through the side channel for hydropower is not always the flow assumed during the evaluation of Plan 2012 in IUGLS. Given those operational changes, GLAM has designed tasks to evaluate whether Plan 2012 releases are providing the benefits expected. Both operational simulations and actual water levels and flows will be used in these evaluations, with record length suitable to the particular issue.

Question 1 – Are models verified by real data?

1.1 Monitoring of Lake Ontario coastal wetland habitat (IWI)

Coastal wetlands provide an ecologically important and biologically diverse transitional zone between open water and land. As water levels rise and fall, vegetation communities move along an elevation gradient, encroaching on exposed soils and receding during flooding. Along this gradient, wetland vegetation transitions among distinct zones from shrubs to meadow marsh to emergent stands and submerged aquatic vegetation beds. It has been shown that wetlands are sensitive to water level changes and require variation in water levels to maintain ecosystem functions as well as diversity. This information is important to evaluating the impact of water-level regulation changes in Lake Ontario and to provide a standardized approach for monitoring wetland ecosystem indicators basin-wide.

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Environment Canada has monitored wetland plant diversity since the end of the Lake Ontario- St. Lawrence River Study. The Lake Ontario Wetlands Monitoring project will continue detailed vegetation community surveys for eight Lake Ontario coastal wetlands along the Canadian shoreline. This work will provide a means to track and understand vegetation zonation in Lake Ontario wetlands including the meadow marsh indicator which was a primary indicator used in the evaluation of alternative regulation plans for Lake Ontario. The monitoring will provide much needed information to validate the Integrated Ecological Response Model (IERM) model outputs with empirical data. Technological advances since the completion of the LOSLR study have greatly increased the scope and accuracy of data to be collected to support wetland ecosystem monitoring with respect to water levels. This project will enhance our current understanding of wetlands and increase the confidence in model outputs. The field surveys will be undertaken in fall 2015 with the data delivered by March 31st, 2016. The IJC has approved \$30K Cdn to this project as part of their IWI program.

Products:

- Complete field surveys for 8 Lake Ontario wetlands sites on the Canadian shoreline.
- Field data input to existing databases, post-processed, reviewed and summary results provided to the IJC's GLAM Committee.
- Executive Summary and Final Summary Report describing key aspects of the field approach and general findings.

1.2 Evaluate meadow marsh algorithm (IWI)

The wetlands meadow marsh performance indicator has been a critical component of the evaluation of water level regulation plan options for the Lake Ontario-St. Lawrence River system and it is important to validate and improve the modelling approach.

This task is to compare the types of plants growing in Lake Ontario wetlands to the types predicted by the IERM used in the LOSLR study and determine whether the IERM predictions are validated by the data. The validation will have three parts:

1. Using the algorithm embedded in the IERM and actual 1945-2014 Lake Ontario levels, calculate a time series of annual elevations labeled A, B, C, D, E, F and G. These lettered elevations are defined by previous Lake Ontario levels. For example, in any year, "B" is the elevation that has not been flooded in the last ten years, "flooded" meaning under still water for 2-3 quarter-months. The letter elevations in turn can be used with area-elevation curves to predict the areas covered with upland, meadow marsh, emergent and submerged vegetation each year. For example, the bottom of the predominantly meadow marsh area is elevation "C".
2. Use the monitored plant data to determine the "actual" areas of upland, meadow marsh, emergent and submerged vegetation each year, and then
3. Compare the two and judge whether the algorithm should be corrected based on the evidence provided by the new plant data.

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The IJC has offered \$40K in IWI funding to support this project. That money will be used to cover the costs of involving Doug Wilcox from SUNY Buffalo and Todd Redder from LimnoTech who were the primary researcher and modeller for this performance indicator (PI). Some preliminary work has been completed with the algorithm and the monitored data at one site for one year to help clarify what needs to be done. Short scopes of work will be drafted and contracting and funding details will be considered once tightly drafted scopes have been developed. EC and USACE staff will be engaged in working to integrate the data into the IERM and in updating the model as required. There will be two experts workshops held as part of this project. The first will be to agree on a process for characterizing the extent of upland, meadow marsh, emergent and submerged vegetation based on the monitored data and to draft a protocol for validating whether the evidence shows the algorithm is sound for its intended purpose, which is to evaluate regulation plan rules.

After we process the monitored data, a second experts workshop will be held to present the initial findings and allow them to be challenged. This project is expected to be completed by Aug 2016.

Products:

- An excel based modelling tool that incorporates recent observed wetland monitoring data and allows for an assessment under actual water level conditions compared to expected performance indicator results from existing planning models used in LOSLR.
- Transfer of expertise on the evaluation tools from contractors to government agencies.

1.3 FEPS model - update based on shore protection information (PI verification)

Shoreline protection maintenance on Lake Ontario is the coastal performance indicator that was found to be most sensitive to the differences among candidate regulation plans during the LOSLR Study. Elevations of existing shore protection structures are estimated within the Flood and Erosion Prediction System (FEPS) database, as are the design characteristics of replacement structures when existing shore protection fails within the model. Sensitivity analysis of the shore protection results suggests that shore protection failure is sensitive to the design water level elevation used within the model and that verification of design water levels for existing and replacement shore protection would provide additional confidence of assumptions used within the model. Following the LOSLR Study work was undertaken through the USACE to conduct on-the-ground surveys of a number of locations along the south shore of Lake Ontario to gather shore protection types, quality and height of structures to compare to key assumptions in the FEPS database. The data is to be delivered to the USACE by the end of October, 2015. The data will then need to be quality checked and formatted correctly to be included into the FEPS database and a number of sensitivity tests conducted to verify model assumptions based on actual measured data. USACE is providing the staff support to integrate the new data into the FEPS database. USACE staff will also be supporting the comparison of FEPS model results using the assumed and field survey data along with staff from EC. The intent is to have the work completed by March 2016.

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Products:

- Updated FEPS database of shore protection types, quality and height for locations where field surveys were undertaken on behalf of USACE.
- Initial comparison of FEPS model results using the baseline model assumption and the site specific structure information (field surveys).

Question 2 – Have Water Supplies changed? – Tracking Hydrologic and Hydraulic Factors

2.1 Track advancement towards improving quality of NBS information

In order to understand how the Great Lakes system is changing over time it is important to understand how all of the components that drive the Net Basin Supply (NBS) are changing over time. Unfortunately there is currently a large amount of uncertainty in these components, especially over-lake precipitation, runoff, and evaporation from the lake surface.

The U.S. Army Corps of Engineers (USACE) currently creates an annual report that summarizes the advancements and continued uncertainty in each of the components of the water budget. NOAA GLERL and EC continue to contribute significant research activities towards reducing the uncertainties as well. This is an ongoing process but contributions will be included in the initial GLAM surveillance summary (see sections 3.1 and 3.2) to be completed by end of March 2016.

Products:

- Integration of USACE annual report on advancements and continued uncertainty into GLAM Committee surveillance summary

2.2 Extended CaPA and GEM hindcasts of water supply components in the Great Lakes basin (IWI)

This work may provide insights that allow rectification of differences in net basin supplies determined by the component and residual methods. That in turn would improve our ability to notice changes in connecting channel conveyance and the onset of climate change and to produce more useful hydrologic data and models for the evaluation of regulation plans.

The Canadian Precipitation Analysis (CaPA) is an operational near real-time gridded precipitation product from Environment Canada available since April 2011 for North America. CaPA has generated a lot of enthusiasm in the Great Lakes area, due to its unique capability of capturing some of the precipitation features that are specific to the Great Lakes, in particular organized shallow convection events which are responsible for lake-effect snowfall. Indeed, because it uses a background field from the Global Environmental Multiscale Model (GEM) atmospheric model, it can represent the effects that the lakes have on the precipitation patterns, something that is very difficult to catch with the existing precipitation gauging network, as it is entirely over-land.

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The objective of this project is to provide the foundation for extending CaPA and GEM hindcasts back to 1983. Samples of daily analyses will be provided (one per week from 1995 until 2012). Furthermore, the computing cost of extending the hindcast back to either 1983 or 1995 at either 50-km or 15-km resolution will be assessed, and the added value of a 15-km analysis will be assessed over the Great Lakes watershed and basins along the entire boundary. Dr. Vincent Fortin from Environment Canada is the lead researcher on this project which has been awarded with \$50K Cdn in IJC IWI funding. The initial project is to be completed by March 2016.

Products:

- CaPA and GEM hindcasts extended to 1995 at a 50-km resolution and an assessment of extending back to 1983 and the added value of a 15-km analysis over the Great Lakes watershed.

2.3 Inventory of available net basin supply (NBS) components for the Great Lakes

As an initial step to improve the quality of NBS information, the current state of the various sources of the NBS components will be inventoried. This will allow the committee to evaluate the current state of NBS information and decide whether any of the current sources need to be examined for possible improvement. It may also identify gaps in the current state of NBS information that need to be filled. The work complements the CaPA hindcast project as well as work undertaken by the USACE and NOAA. The work will primarily be carried out by EC staff through their contributions to the Coordinating Committee and is anticipated to be completed by September 2016.

Products:

- Inventory of current state of NBS component information.

2.4 Review and update of historical hydrologic and hydraulic datasets for the Lake Ontario – St. Lawrence River system through Montreal and St. Lawrence River

In order to effectively assess the current regulation plan relative to others it is necessary to review the hydrologic and hydraulic datasets from the currently coordinated historical period of record, and produce updated or extended historical datasets that include more recent data. For Lake Ontario, the current historical period of record for data required to evaluate regulation plan performance covers the period from 1900-2000. This data includes Lake Ontario and St. Lawrence River water levels; Lake Erie and Lake Ontario outflows; Lake Ontario residual net basin supplies; Lake St. Louis outflows and lower St. Lawrence tributary flows; St. Lawrence River rating equations and ice and weed retardation factors, some of which are estimates or proxies prior to 1960. This project will be undertaken jointly by EC and USACE staff, and will involve the development of metadata and a documented process for ongoing updates to Lake Ontario hydrologic and hydraulic data on an annual basis going forward, and a review

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and update of the required datasets through 2014. This can be completed with internal resources and completed by August 2016.

Products:

- Metadata for all hydrologic and hydraulic datasets required for LOSLR plan formulation and evaluation
- Documented process for annual updates
- Review and update to historical datasets for the 1900-2014 period-of-record

Question 3 – Has the system changed, and what is impacted by changes (physical, environmental, socio-economics)?

3.1 Design a surveillance plan

This task is to design a process that would allow the GLAM Committee to more effectively capture and apply information that is not being monitored in specific GLAM Committee projects, but which could be useful to improved lake level regulation. The GLAM Committee uses the term “monitoring” to refer to a very focused act of making observations linked explicitly to performance indicators through the performance indicator algorithm, and “surveillance” to refer to scanning for information that could affect the outcomes of lake level regulation but which is not explicitly tied to any current GLAM performance indicator (as developed in the LOSLR and IUGLS studies). The objective of surveillance is to find useful information we weren’t looking for. The focal length of surveillance begins where monitoring leaves off; for example, tracking scientific papers to see if there is information available through outside sources that could help update existing performance indicators or that could have an influence on existing or new performance indicators. The actual height of shore protection structures and the variety of plant species growing at different elevations along the coast are two examples of monitoring. Other surveillance efforts could cast an even wider net, looking for climate research that might improve forecasting if applied to the Great Lakes net basin supplies, discovering a new category of water level related impacts or even tracking an economic trend that could have a bearing on how levels should be regulated.

This task is to find a way to move from the accidental, anecdotal surveillance system we have now *towards* a system that catches more useful knowledge and little else in a way that is not difficult, time consuming, or expensive. The primary objective is to create a framework for design by describing the components and functions of the system. As a start, there will be **scanning** element that finds potential sources of information, a **screening** element that systematically evaluates information in terms of whether it is likely to be useful (and documents the exclusions for later use if necessary), rates the useful information in terms of priority and eliminates information that will likely not be useful, an **interpretation** part that connects the knowledge found to a possible improved outcome from lake level management and a **librarian** function – a service that brings relevant surveyed knowledge to lake level

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management actions as necessary. Some areas for surveillance may include a review of the scientific literature and agency grey literature to determine if there is any recent research linking water levels and socio-economic and/or environmental impacts and water levels. It could include information that could help to update the contextual understanding of the various interest groups and what may be changing that could influence impacts. While components of the surveillance plan may require additional funding (see 3.2.1-3.2.3), the development of the initial surveillance framework will be completed by GLAM Committee members and agency support staff by June 2016. The initial framework will be utilized in the assessment of next steps in FY 2017.

Products:

- An initial framework for developing an on-going surveillance plan (including scope, timing, costs etc.)
- A initial summary report on what is learned through the surveillance efforts listed below for use in the annual priority setting exercise

3.2 Initial surveillance to determine what has changed and whether there are new data and models available to support AM effort

The IJC has some funds available for the GLAM Committee to spend this Canadian fiscal year (Apr/15-Mar/16). Since it has been a number of years since the LOSLR study was completed and 3 years since IUGLS was completed, an important first step is to determine what has changed since the studies were completed and what data and information might be available to assist the GLAM Committee. The following will be developed to be complementary with the scope of the surveillance plan initiated in 3.1 as follows:

3.2.1 Ecosystem surveillance:

Identify any new scientific literature on impacts of water levels to the ecosystem and identify any performance indicators that might be important moving forward that were not addressed by the LOSLR or IUGLS studies; identify any changes to the system or emerging environmental issues that could impact existing and/or performance indicators (e.g. Phragmites). Approximately \$20K Cdn in IJC funding will be used to carry out the work with a planned completion date of March 2016. EC and other GLAM Committee support staff will be providing in-kind support for establishing the contract and providing oversight.

Product: Updated ecosystem contextual narratives. Database of important and related scientific research; Assessment report on available ecosystem related data sources and models/tools that could support AM effort.

3.2.2 Socio-economic surveillance:

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Identify any new scientific literature on socio-economic impacts of water levels to sectors including shoreline property, commercial navigation, hydropower, recreational boating and tourism, municipal and industrial water uses and identify any performance indicators that might be important moving forward that were not addressed by the LOSLR or IUGLS studies; Identify any changes to the system or emerging issues that could impact existing economic performance indicators (e.g. more houses built in flood plain). Approximately \$25K Cdn in IJC funding will be used to carry out the work with a planned completion date of March 2016. EC and other GLAM Committee support staff will be providing in-kind support for establishing the contract and providing oversight.

Product: Updated socio-economic contextual narratives. Database of important and related scientific research; assessment report on available socio-economic data sources and models/tools that could support AM effort.

3.2.3 Surveillance of physical changes and modelling tools

Review of scientific literature and GLAM NBS project mentioned above to identify any possible changes to the physical system that could influence the regulation of water levels and flows (e.g. climate change; conveyance changes, changes to flood zones etc.) as well as assessments of the current state of the data, models and tools for assessing the physical changes to the system. Approximately \$20K Cdn in IJC funding will be used to carry out the work with a planned completion date of March 2016. EC and other GLAM Committee support staff will be providing in-kind support for establishing the contract and providing oversight.

Product:

- Contextual narrative on how the Great Lakes system may be changing based on existing literature and a written assessment of the current state of data, models and tools available for assessment of changes to the physical system including the climate of the system.
- A initial summary report on what is learned through the surveillance efforts for use in the annual priority setting exercise and integrated into the plan evaluation process itself

Question 4 – Can the regulation plan be improved?

4.1 Review operational issues related to implementation of Plan 2012 and conditions in the St. Marys Rapids

Recent high outflows prescribed by Plan 2012 due to higher water levels on Lake Superior combined with hydropower outages has led to concerns being raised regarding the impacts of both higher and fluctuating flows and levels on the St. Marys Rapids, specifically the impact on the rapids fishery and recreational anglers, and the potential for flooding of Whitefish Island. There has also been concern

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regarding the risk of ice damage to the Compensating Works and structures in the lower St. Marys River when the gates are first opened following winter, the impacts of “unnecessarily spilled” water on hydropower production, and impacts to commercial navigation due to reduced levels in the lower St. Marys River if gate settings were reduced. Three tasks have been identified as a priority to initiate during this first year work plan.

4.1.1 Review the impacts of reductions in maximum side-channel capacity due to hydropower outages and other limitations and develop optimal operational guidelines for addressing them

Plan 2012 was developed and tested during the IUGLS assuming a maximum side channel capacity of 2320 m³/s, and this assumption has carried through to the operational implementation of Plan 2012 as well. However, this constant value is based on a number of assumptions that are essentially representative of a specific set of near “ideal” conditions, and often these conditions do not exist. In particular, these assumptions do not reflect actual operational conditions in two important ways:

i. Hydropower outages

The maximum side-channel capacity of 2320 m³/s is based on the assumption that all three of the hydropower plants are running all generating units at full capacity, but the reality is that most years there are a number of scheduled and unscheduled outages at the hydropower plants that result in unit outages and a reduction in the maximum capacity of the plants.

ii. Variations in hydrologic conditions

Even when all hydropower generating units are available and running, the flow capacity of these units varies as a result of variations in hydrologic conditions, most notably changes in water levels and ice conditions. There is also a specific concern that because side-channel capacity is often limited in winter that the maximum winter flow of 2410 m³/s prescribed by Plan 2012 is unattainable (under the normal one-half gate equivalent winter setting), and this may have consequences in terms of high water levels during the following spring and summer.

This task will be to investigate the impacts of hydrologic conditions on maximum hydropower plant capacity and develop mathematical relationships that relate the two and which can be incorporated into evaluation and operational models/tools. It will also be to review the impacts of reduced side-channel capacity in winter, notably the potential for higher Lake Superior levels in spring/summer than were estimated during IUGLS plan formulation and evaluation, and how to address this issue. Finally, this task will include a study of the impacts of large and fluctuating flows in the St. Marys River due to varying maximum side-channel capacity, and develop and evaluate methods to address these impacts. This analysis should consider the positive and negative impacts on impacted stakeholder groups. Recommendations should include rules, limits, and/or guidelines

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that the Board could follow in addressing these issues, including the potential use of deviations from Plan 2012 or permanent changes to Plan 2012 itself. Staff of the Lake Superior Board at EC have begun to investigate the relationships between hydropower capacity and hydrologic conditions using limited data when the plants were running at full capacity recently; this analysis would benefit from additional data (both from the past or available in the near future) and from involvement of the hydropower operators themselves. It is expected this task can be conducted with GLAM Committee staff at EC and USACE through the Board regulation representative offices and initial products completed by August 2016. Based on these initial products an assessment will be made of what further work required in next fiscal year's work plan.

Products:

- Draft Report on varying hydropower plant capacity due to hydrologic conditions
- Evaluation and initial draft report on impacts and potential strategies to address reductions in hydropower capacity

4.1.2 Review the use of multiple partially open gate settings at the Compensating Works and impacts on St. Marys River stakeholders

As a result of the recent rise in upper Great Lakes water levels, regulated outflows from Lake Superior through the St. Marys River have also increased, and this has required the gate setting of the Compensating Works at the head of the St. Marys Rapids to be increased above the minimum one-half gate equivalent. A number of concerns have been raised in using fully open gates including the impacts of higher flows and levels on the St. Marys Rapids fishery and recreational anglers, potential flooding of Whitefish Island, the risk of ice damage to the Compensating Works and structures in the lower St. Marys River, the impacts of "spilled" water on hydropower production, and impacts to commercial navigation due to reduced levels in the lower St. Marys River if gate settings were reduced. Since May 2014 the Superior Board began employing multiple partially open gates in lieu of fully open gates in order to provide a number of potential benefits in the St. Marys Rapids. One issue with this new approach is that the existing hydraulic relationships and the flow measurements used to verify the relationships are applicable to flow through fully open gates at the Compensating Works only, and cannot be applied to partially open gate settings. Flows through the partially open gates have been calculated using standard, textbook gated flow equations. Flows through the Compensating Works constitute a significant component of the overall flow through the St. Marys River, particularly during periods of high flows when they make up a greater proportion of the total. Therefore, understanding the relationships between water levels and flows through partially open gates is critical to the operation of the Compensating Works and to the determination and regulation of the total outflow from Lake Superior.

In this task the GLAM Committee and support staff will work with stakeholders, including ecosystem/fisheries scientists, recreational anglers, First Nations/Whitefish Island and hydropower operators, to develop a better understanding of the advantages and disadvantages of partially open gate settings. If necessary, any issues may be addressed through modifications to the

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Coordinated Great Lakes Regulation and Routing Model (CGLRRM), Plan 2012 and/or the operational guidelines for Lake Superior regulation. The Superior Board staff working with the GLAM Committee will use recently collected St. Marys Rapids flow measurements at partially open gate settings, to begin to develop and verify partially open gated flow equations and these equations will need to be incorporated into the CGLRRM so that it could be used operationally by the Board for Lake Superior regulation and by GLAM for the ongoing evaluation of regulation plans. It is expected this task can be conducted with GLAM Committee staff at EC and USACE through the Board regulation representative offices and initial products completed by August 2016. Based on these initial products an assessment will be made of what further work required in the next fiscal year.

Products:

- Initial report on benefits/disadvantages to stakeholders of partially open gate settings
- Initial joint report with Superior Board on partially open gate setting flow relationships for operational implementation and incorporation into CGLRRM

4.2 Develop a shared vision planning/modelling process for the on-going evaluation and ranking of alternative regulation plans

Detailed plan evaluation processes were established in each of the LOSLR and IUGLS studies that allowed Study Boards and the IJC to effectively rank regulation plans. The challenge to the GLAM Committee is to establish an appropriate plan evaluation process for the on-going review of the regulation plans while taking full advantage of the data, models and tools previously developed.

The first objective of this task is to provide a clear protocol that explains how the past evaluations were done and provides easy access to the models and data needed to run the evaluations. Subtasks for this work are:

- Write a short paper summarizing the available information on running evaluations, including access to the necessary models and data, and determine what additional work is necessary. The paper would include a short discussion of how the ranking protocols, which are now different for Lake Ontario and Lake Superior plans, determines how plans are evaluated.
- Identify important sensitivity analyses that could be undertaken to test model assumptions and identify areas of greatest uncertainty.

The second objective is to develop processes for updating/changing the evaluation process. This could include writing a paper that describes the potential for change in each major element of the existing evaluation framework matrix from the LOSLR and IUGLS and outlining a process for making those changes. It could also include the development of GLAM procedures for ratifying changes. For example, we expect new information regarding shore protection structures in New York that have the potential to change the LOSLR estimates of damage. The GLAM procedure would include a method for determining and documenting whether the new information was different enough to warrant a change in the shore protection element of the FEPS model, a procedure for designing and approving those

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changes (including requirements for communication with stakeholders, the Boards, and the IJC). It is expected that the development of the On-Going Evaluation Process will be initiated this fiscal year, but will not be fully developed until a number of initial products from this annual work plan can be assessed and utilized.

Product:

- A paper describing the potential for change in each major element of the existing evaluation framework matrix from the LOSLR and IUGLS and outlining a process for making those changes.
- A GLAM procedures for ratifying changes
- Guidelines for developing a shared vision process for the on-going review of the regulation plans (scope, process, engagement, time horizon etc.)

4.3 Learning phase and test run of existing evaluation models using any updated information/tools and various scenarios

While a focus of the GLAM Committee in the initial years will be to establish the shared vision planning for the on-going plan evaluation process as described in task 4.2 above, the purpose of this task is to initiate a learning phase with technical staff to allow them to run the existing and/or updated evaluation models and tools so more people know how to use the SVM. Some test sensitivity analyses with updated information as examples could be used to teach GLAM Committee support staff how to run through an evaluation process so they can begin to familiarize themselves with the tools and methods. The test evaluation could use all updated models/tools for example the updated wetlands model developed as part of task 1.2, the new shore protection design heights for coastal damages in the FEPS from task 1.3, and new data an information from varying hydropower plant capacity from task 4.1.1 and partially open gate setting flow relationships from Task 4.1.2 as well and any new or revised water supply sequences and performance indicators that are available to the GLAM Committee. The plan evaluations could be re-run and tested under different scenarios and using examples of different sensitivity analyses to determine where areas of greatest uncertainty exist and where model improvements might be possible. During this phase, a help page will be developed for known issues with the evaluations, such as the difficulties in running IUGLS shore protection code. The test process will include documentation of what was done, lessons learned and recommendations for improvements in the future. The work is expected to be completed by September 2016 using staff contributions from USACE and EC along with GLAM Committee participants.

Product:

- A tutorial based on a short paper summarizing the available information on running evaluations, including access to the necessary models and data outlined in 4.2
- A paper documenting the tests run, lessons learned and recommendations for improvements in the future

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Section B: Management and Administration

5. Coordination, Management, Operation and Oversight of Work of GLAM Committee

5.1 GLAM Committee Coordination, Management, and Reporting

This is a basic task that includes the on-going coordination, management operation and oversight of GLAM Committee activities and working groups. It includes primarily the work of the co-chairs, secretaries and their staff who help support the operation of the GLAM Committee. This activity is supported primarily through the USACE and EC with some operation and maintenance funds provided through the IJC-Ottawa. This is an on-going activity. There are a series of sub-tasks associated with the ongoing GLAM Committee Coordination, Management, and Reporting.

5.1.1 Prepare and submit annual work plan

Each year the GLAM Committee will prepare an annual work plan for submission to the Boards outlining the activities to be undertaken and products to be delivered in support of the adaptive management process. The work plan will identify the priority work items, the project leads, timeline, any external costs, GLAM Committee contributions and product deliverables. This will be submitted to the Boards in advance of their fall semi-annual meeting and presented to the Boards at their fall meeting. The Boards will present the work plan to the IJC at the IJC Appearances. The Boards may request the GLAM Committee co-chairs to present the work plan on their behalf to the IJC.

Product:

- Annual work plan for FY 2017 for submission to the Boards

5.1.2 Establish working groups

Each item within the annual work plan will need project managers and in many cases a team to complete. These teams need to be assembled quickly as soon as the annual work plan is approved by the Boards/IJC. The GLAM Committee members are to identify any internal resources (staff, etc.) that they can bring to the annual work plan efforts.

Product:

- A list of team leads and team members for each product.

5.1.3 Develop semi-annual reports

As per the IJC Directive, the GLAM Committee will prepare a semi-annual progress report outlining the status of the GLAM Committee in meeting the commitments of their annual work plan. This progress report will be prepared by the GLAM Committee secretaries and co-chairs and presented to the Boards

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at their March meetings in advance of the IJC Appearances. The Boards will report on progress to the IJC or may ask the GLAM Committee co-chairs to present on their behalf.

Product:

- A semi-annual progress report for submission to the Boards in March 2016

Strategic Planning

5.2 Develop triennial report outline

The first Triennial Report of the IJC on the progress of the Great Lakes Water Quality Agreement is due in January 2017. As per the GLAM Committee's Directive from the IJC, the GLAM Committee shall report to the IJC on a similar schedule. Given that the first Triennial report is only a year and a half away, it is a priority of the GLAM Committee to develop a 2017 report outline that can be agreed upon by the Committee and shared with the Boards and IJC well in advance so that there is agreement on what is expected. This will be completed by the GLAM Committee by March 2016.

Product:

- An annotated outline of the January 2017 Triennial Report

5.3 Prepare a mid-term strategic plan

In addition to the annual work plan, the GLAM Committee will develop a longer time-horizon plan that supports the long-term requirement for a 15 year full evaluation of the regulation plan. The mid-term strategic plan allows the GLAM to consider what can be done within a 3-5 year time horizon and the stages required to support the 15 year plan evaluation. The 3-5 year outlook of a mid-term strategic plan will consider important stages of the adaptive management process and provide a broader planning horizon over which to consider the arc of an adaptive management process. The first mid-term strategic plan will be completed and presented to the Boards by their Fall 2016 meeting using GLAM Committee resources.

Product:

- A mid-term strategic plan covering 2015-2017 inclusive and looking out to 2020.

Operating Procedures

5.4 Establish annual priority setting procedures

Each year the GLAM Committee will be required to establish priorities in supporting the overall adaptive management process. With limited funding and resources, the GLAM Committee in consultation with the Boards will have to choose which activities have the highest priority for that year. To undertake this prioritization, the GLAM Committee will develop a set of criteria for ranking priorities. The GLAM

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Committee will establish a standard procedure for ranking and prioritizing tasks by December 2015. This will be undertaken as a GLAM Committee exercise and no external funding is necessary.

Product:

- A written process for evaluating annual priorities

Quality Assurance and Quality Controls

5.5 Monitoring of the work plan delivery

The GLAM Committee secretaries in conjunction with the GLAM Co-chairs will lead the effort to develop the details of how the work plan will be monitored and controlled. This could include, for example EC Worksheets; USACE controls; contractor requirements; semi-annual reporting; project assurance by IJC advisors and Board members, etc. The strategy for monitoring work plan delivery will be developed by the GLAM Committee by the end of December 2015.

Product:

- Mechanisms will be established and in place for monitoring work plan delivery

Information Management – Data portal/Data visualization

5.6 Establish internal information management system

A key priority as the GLAM Committee initiates its work is to have a means for internal communication. This task will focus on setting-up and utilizing internal information management mechanisms such as a share point site and ftp sites for exchanging files and sharing documents, data and models. The work will largely be conducted by the secretaries as is expected to be operational by June 2016.

Product:

- An effective framework for sharing GLAM files (includes Sharepoint, website, etc.)

6. Communication, Outreach and Engagement

A Communications, Outreach and Engagement strategy has been developed and shared with the Boards of Control. This strategy outlines the basic communication principles, procedures, products and tactics for on-going communications, outreach and engagement. In the first year, the GLAM Committee will strive to undertake the following items within that strategy.

6.1 Develop story line of the evolution of the GLAM

This task will assist in communicating the history and objectives of the GLAM Committee to government agencies, organizations/interest groups, academia, and stakeholders. The success of the GLAM

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Committee will depend on outreach to, and the engagement of outside parties in order to take advantage of research, studies, projects, and other efforts that may coincide with GLAM objectives. Explaining the history and objectives of the Committee will be a crucial communication tool to provide a consistent and clear message when engaging parties that may be able to assist in the needs of the GLAM effort. This story line will be developed by the GLAM Committee with support from IJC Communications staff by December 2015.

Product:

- A standard presentation and fact sheet on what the GLAM Committee is and what it does for distribution and posting to GLAM Committee website.

6.2 Engage with agency senior management to encourage collaboration, sharing, and exchanging information

The engagement of government agencies will be a key element to leverage existing or future agency efforts to support the monitoring and/or research needs required for the on-going assessment of the regulation plans. Engagement with agency senior management may be accomplished by developing a list of key agencies, establishing a point of contact for each agency, and create a consistent communication frequency and method. Members of the GLAM Committee will support this effort with the intent of a preliminary product by December 2015.

Product:

- Identify a network of key agency representatives

6.3 Develop stakeholder circles of influence

The engagement of stakeholders will assist in the evaluation of indicators used to measure the impact to the six areas of interest including domestic, municipal, and industrial water uses, commercial navigation, hydroelectric generation, ecosystems, coastal zone, and recreational boating and tourism. Ideally, the stakeholder circles of influence will consist of identifying individuals to represent each interest and establish a consistent communication method by which they may be engaged. The circles of influence members may be asked to provide input on current algorithms used to calculate indicators, or to provide information on changes occurring within the system. Members of the GLAM Committee will support this effort with the intent of a preliminary product by March 2016. Input from the Boards of Control will be sought.

Product:

- A completed table outlining the current state of the relationship between key stakeholders and the GLAM Committee members and Board members.
- A list of key contacts representing various circles of influence

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6.4 Establish a research community network

The engagement of the research community (i.e. academia) will be another important element to leverage existing or future efforts to support the monitoring and/or research needs required for the on-going assessment of the regulation plans. Engagement with academia may be accomplished by developing a list of universities, professors, or other individuals to encourage new, or take advantage of existing research efforts that may aid the GLAM Committee in reducing uncertainty of certain indicators, or identify new indicators over time. This effort will be led by members of the GLAM Committee with anticipated completion by March 2016.

Product:

- Develop a list of research organizations and contact information for individuals who the GLAM Committee can reach-out to on a fairly regular basis

6.5 Establish appropriate connections related to the Great Lakes Water Quality Agreement

The IJC Directive to the GLAM Committee specifically highlights the importance of ensuring coordination and liaison between the Great Lakes control boards and the boards created by the Great Lakes Water Quality Agreement (GLWQA) – the Great Lakes Water Quality Board (WQB) and Science Advisory Board (SAB). To better link water levels and flows regulation with water quality considerations, the GLAM Committee is requested to engage in outreach activities with the WQB and SAB. The GLAM Committee co-chairs have committed to participating in joint meetings of the WQB and SAB. Additionally, the GLAM Committee needs to identify the most appropriate connections with the GLWQA Annex activities through the Great Lakes Executive Committee related to habitat, biodiversity, ecosystem indicators and climate change impacts. This task will be to establish an appropriate list of GLWQA connections by December 2016.

Product:

- A list of appropriate GLWQA contacts for review by IJC and GLEC

6.6 Develop and engagement plan for advisory networks

As the GLAM Committee works to identify important representative to support agency networks, stakeholder, and academia advisory groups and GLWQA connections, the GLAM Committee will need to work to develop an engagement strategy for each network. This will build upon the Communications, Outreach and Engagement Strategy by providing details of how and when the GLAM Committee should/could engage with each network and what mechanisms they will use to reach out to the various representatives and how they will be engaged. It will also consider resources and timelines and will directly feed into next year's annual work plan. This effort will be led by members of the GLAM Committee with support from IJC staff with anticipated completion by August 2016.

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Product:

- Detailed engagement strategy of GLAM advisory networks

Section C: Other Special Projects Requested by the Board(s)

From time to time the Boards of Control may have special questions that they wish the GLAM Committee to address. These requests will be made in writing to the GLAM Committee as special reference projects and will be included in the annual work plans. No special Board projects have been included in this first year work plan.

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Work Plan Table

1. Are Models Verified by Real Data?					
Task	Proposed Task	Proposed Products	Estimated GLAM Support	Estimated Supplemental Support	Estimated Delivery
1.1	Monitoring of Lake Ontario coastal wetland habitat (IWI)	1) Complete field surveys for 8 Lake Ontario wetlands sites on the Canadian shoreline 2) Field data input to existing databases, post-processed, reviewed and summary results provided to the IJC's GLAM Committee 3) Executive Summary and Final Summary Report describing key aspects of the field approach and general findings	Other (0.05)	EC (0.3 FTE) IJC IWI CAN (\$30K) OMNRF (~\$40K for imagery to supplement specific sites)	Mar-16
1.2	Evaluate meadow marsh algorithm (IWI)	1) An excel based modelling tool that incorporates recent observed wetland monitoring data and allows for an assessment under actual water level conditions compared to expected performance indicator results from existing planning models used in LOSLR. 2) Transfer of expertise on the evaluation tools from contractors to government agencies.	EC (1) USACE (0.025) Other (0.1)	IJC IWI US (\$45K)	Aug-16
1.3	FEPS models - update based on Shore Protection Information (PI verification)	1) Updated FEPS database of shore protection types, quality and height for locations where field surveys were undertaken on behalf of USACE. 2) Initial comparison of FEPS model results using the baseline model assumption and the site specific structure information (field data).	USACE (0.3) EC (0.2) Other (0.05)		Mar-16
2. Have Water Supplies Changed? Tracking Hydrologic and Hydraulic Factors					
2.1	Track Advancement Towards Improving Quality of NBS Information	1) Integration of USACE annual report on advancements and continued uncertainty into GLAM Committee surveillance summary.	USACE (0.05) Other (0.05)		Mar-16
2.2	Extended CaPA and GEM Hindcasts of Water Supply Components in the Great Lakes Basin (IWI)	1) CaPA and GEM hindcasts extended to 1995 at a 50-km resolution and an assessment of extending back to 1983 and the added value of a 15-km analysis over the Great Lakes watershed.	EC (0.025)	EC (0.2) IJC IWI CAN (\$50K)	Mar-16

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Task	Proposed Task	Proposed Products	Estimated GLAM Support	Estimated Supplemental Support	Estimated Delivery
2.3	Inventory of Available NBS Components for the Great Lakes	1) Inventory of current state of NBS component information.	EC (0.05)		Sep-16
2.4	Review and Update of Historical Hydrologic and Hydraulic datasets for the Lake Ontario - St. Lawrence River system through Montreal and the St. Lawrence River	1) Metadata for all hydrologic and hydraulic datasets required for LOSLR plan formulation and evaluation 2) Documented process for annual updates 3) Review and update to historical datasets for the 1900-2014 period-of-record	EC (0.25) USACE (0.05)		Aug-16
3. Has the System Changed and What is Impacted? (physical, environmental, socio-economic)?					
3.1	Design a Surveillance Plan	1) An initial framework for developing an on-going surveillance plan (including scope, timing, costs etc.) 2) A initial summary report on what is learned through the surveillance efforts listed below for use in the annual priority setting exercise	USACE (0.05) EC (0.1) Other (0.1)		Jun-16
3.2	Initial Surveillance to determine what has changed and whether there are new data and models available to support AM effort. Includes subtasks: - 3.2.1: Ecosystem Surveillance - 3.2.2: Socio-economic Surveillance - 3.2.3: Surveillance of physical changes and modelling tools	1) Updated ecosystem contextual narratives. Database of important and related scientific research; Assessment report on available ecosystem related data sources and models/tools that could support AM effort. 2) Updated socio-economic contextual narratives. Database of important and related scientific research; assessment report on available socio-economic data sources and models/tools that could support AM effort. 3) Contextual narrative on how the Great Lakes system may be changing based on existing literature and a written assessment of the current state of data, models and tools available for assessment of changes to the physical system including the climate of the system. 4) A initial summary report on what is learned through the surveillance efforts for use in the annual priority setting exercise and integrated into the plan evaluation process itself	EC (0.3) USACE (0.1) Other (0.05)	IJC CAN (\$70K)	Mar-16

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4. Can the Regulation Plan Be Improved?					
Task	Proposed Task	Proposed Products	Estimated GLAM Support	Estimated Supplemental Support	Estimated Delivery
4.1.1	Review the impacts of reductions in maximum side-channel capacity due to hydropower outages and other limitations and develop optimal operational guidelines for addressing them	1) Draft Report on varying hydropower plant capacity due to hydrologic conditions 2) Evaluation and initial draft report on impacts and potential strategies to address reductions in hydropower capacity	EC (0.5) USACE (0.25)		Aug-16
4.1.2	Review the use of multiple partially open gate settings at the Compensating Works and impacts on St. Marys River stakeholders	1) Initial report on benefits/disadvantages to stakeholders of partially open gate settings 2) Initial joint report with Superior Board on partially open gate setting flow relationships for operational implementation and incorporation into CGLRRM	USACE (0.25) EC (0.2)		Aug-16
4.2	Develop a shared vision planning/modelling process for the on-going evaluation of regulation plans	1) A paper describing the potential for change in each major element of the existing evaluation framework matrix from the LOSLR and IUGLS and outlining a process for making those changes. 2) A GLAM procedures for ratifying changes 3) Guidelines for developing a shared vision process for the on-going review of the regulation plans (scope, process, engagement, time horizon etc.)	EC (0.25) USACE (0.15) Other (0.05)		Jun-16
4.3	Learning Phase and test run of evaluation process using any updated information/tools of various scenarios	1) A tutorial based on a short paper summarizing the available information on running evaluations, including access to the necessary models and data outlined in 4.2 2) A paper documenting the tests run, lessons learned and recommendations for improvements in the future	USACE (0.6) EC (0.4) Other (0.05)		Sep-16

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GLAM Committee Coordination, Management, and Reporting					
Task	Proposed Task	Proposed Products	Estimated GLAM Support	Estimated Supplemental Support	Estimated Delivery
5.1	GLAM Committee Coordination, Management and Reporting Includes: - 5.1.1: Prepare and submit annual work plan - 5.1.2: Establish working groups - 5.1.3: Develop semi-annual reports	1) Annual work plan for FY 2017 for submission to the Boards 2) A list of team leads and team members for each product. 3) A semi-annual progress report for submission to the Boards in March 2016	EC (0.45) USACE (0.45)	IJC CAN (\$20K)	Sep-16
Strategic Planning					
5.2	Develop triennial report outline	1) An annotated outline of the January 2017 Triennial Report	USACE (0.1) EC (0.1)		Mar-16
5.3	Prepare mid-term strategic plan	1) A mid-term strategic plan covering 2015-2017 inclusive and looking out to 2020.	EC (0.2) USACE (0.15) Other (0.05)		Sep-16
Operating Procedures					
5.4	Establish annual priority setting procedures	1) A written process for evaluating annual priorities	USACE (0.1) EC (0.1) Other (0.05)		Dec-15
Quality Assurance and Quality Controls					
5.5	Monitoring of the work plan delivery	1) Mechanisms will be established and in place for monitoring work plan delivery	EC (0.05) USACE (0.05)		Dec-15
Information Management					
5.6	Establish internal information management system	1) An effective framework for sharing GLAM files (includes Sharepoint, website, etc.)	USACE (0.1) EC (0.125) Other (0.05)		Jun-16

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6. Communication, Outreach, and Engagement					
Task	Proposed Task	Proposed Products	Estimated GLAM Support	Estimated Supplemental Support	Estimated Delivery
6.1	Develop story line of the evolution of the GLAM	1) A standard presentation and fact sheet on what the GLAM Committee is and what it does for distribution and posting to GLAM Committee website.	EC (0.045) USACE (0.03) Other (0.05)	IJC Staff time (TBD)	Dec-15
6.2	Engage with agency senior management to encourage collaboration, sharing, and exchanging information	1) Identify a network of key agency representatives	EC (0.045) USACE (0.03)	IJC Staff time (TBD)	Dec-15
6.3	Develop stakeholder circles of influence	1) A completed table outlining the current state of the relationship between key stakeholders and the GLAM Committee members and Board members. 2) A list of key contacts representing various circles of influence	EC (0.045) USACE (0.03)	IJC Staff time (TBD)	Mar-16
6.4	Establish a research community network	1) Develop a list of research organizations and contact information for individuals who the GLAM Committee can reach-out to on a fairly regular basis	EC (0.035) USACE (0.03)	IJC Staff time (TBD)	Mar-16
6.5	Establish appropriate GLWQA connections	1) A list of appropriate GLWQA contacts for review by IJC and GLEC	EC (0.01) USACE (0.075)	IJC Staff time (TBD)	Dec-15
6.6	Develop an engagement plan for advisory networks	1) Detailed engagement strategy of GLAM advisory networks	EC (0.045) USACE (0.03)	IJC Staff time (TBD)	Aug-15

Estimated GLAM Support

EC: 4.5 FTE
USACE: 3.1 FTE
Other: 0.7 FTE

Estimated Supplemental Support

IJC IWI CAN (\$80K)
IJC IWI US (\$45K)

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IJC CAN (\$90K)
 OMNRF (\$40K)
 EC: (0.5 FTE)
 IJC Communications Staff: (TBD FTE)

POSSIBLE FALL IWI SUBMISSIONS (See Appendix for Full Description)

Has the System Changed and What is Impacted? (physical, environmental, socio-economic)?					
Task	Proposed Task	Proposed Products	Estimated GLAM Support	Estimated Supplemental Support	Estimated Delivery
	Determine influence of regulation on LO Phragmites (develop a project strategy to undertake work)	1) The design of an AIS monitoring approach	TBD	TBD	TBD
Information Management					
	Develop an Information Management Plan (includes a process for sharing interim results that GLAM members are interested in (e.g. Sharepoint))	1) Brief strategy document outlining key Information Management guidance for use by the Committee	TBD	TBD	TBD

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Work Plan Annex: Background/Work Plan Context:

Principles

The following are a set of principles that will guide the work of the GLAM Committee and the implementation of this Annual Work Plan by:

1. Adhering to the existing authorities of the Boards and IJC and the existing procedures for making changes to a regulation plan
2. Conforming to meet the IJC Directive to the GLAM Committee
3. Addressing the long-term (15 year) reporting horizon, the mid-term triennial reporting period and short-term annual progress reporting and not within-year decisions.
4. Being product based
5. Addressing how a plan is performing under recent shorter term conditions (past number of years based on real data) and how a plan performs under variable and extreme conditions (scenario based evaluations)

Adaptive Management Framework

This annual work plan represents an action plan of activities required to carry out effective adaptive management. It is based on a system-wide framework for decision support through state-of-the-art hydroclimate and climate change science for the Great Lakes - St. Lawrence River system; on-going understanding of risk and how the system is changing; tools for developing and evaluating regulation plans; and linking that information and knowledge with the Boards of Control and IJC who make decisions from a water levels management perspective and those most affected by those decisions. The overall AM Framework includes five interrelated and interdependent components that together provide the information, tools and process for on-going and adaptive decision making. These components include:

1. Hydroclimate Monitoring and Modeling
2. Performance Indicators and risk assessment
3. Plan Evaluation tools and process
4. Information Management and Distribution
5. Communication, Outreach and Engagement

These five components provide the basis for supporting the principles of adaptive management, to monitor, evaluate, learn and adjust and form a basis for this annual work plan.

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Work Plan Prerequisites and External Dependencies

Prerequisites required to ensure the success of this work plan include the on-going annual support of the agencies represented on the GLAM Committee along with additional staff support as identified by those agencies. It also assumes that funding confirmed by the IJC in the order of \$80K Cdn and \$45K U.S. to support a number of approved IWI projects will be forthcoming and that a base level of funding promised by the IJC (\$90K Cdn and \$5K US) will also be made available and that the mechanisms for ensuring the transfer of funds to the supporting agencies are in place. The priorities set within this work plan assumed the current regulation plans including Lake Superior Plan 2012 and Plan 1958 DD regulating the outflows of Lake Ontario were in place. Should the IJC's recommended Plan 2014 be implemented within the fiscal year, this could have implications to the work priorities established. The work plan might also be affected by water level conditions should any of the lakes move into extreme conditions within the year, and this could alter the prioritization and/or addition of new tasks.

As this is an on-going effort and this represents the first annual work plan, the priorities set and commitments made are estimates based on what the Committee understand to be the resources available. The expertise available through the agencies is still being evaluated relative to the priorities identified. There may in fact be need to readjust proposed products depending on the expertise required and available to complete the task. These assessments will occur throughout the year as the work plan progresses. Should the GLAM Committee determine that they are not able to deliver on any of the products identified, they will notify the Boards through the Board secretaries.

Lessons Incorporated

While the GLAM Committee is a newly established Committee of the IJC, it is not starting from scratch. The GLAM Committee has the benefit of two major IJC studies on the regulation plans – the International Upper Great Lakes Study (IUGLS) and the Lake Ontario-St. Lawrence River (LOSLR) study – which both concluded that adaptive management is the best way to address the uncertainties associated with climate change and the potential for extreme water levels and their associated impacts. These studies provide the backbone from which the adaptive management effort can be built, including the development of multiple water supply sequences, performance indicators, evaluation tools and models, along with a process for evaluating and ranking regulation plans. In essence, the AM effort begins where the studies left off and recognizes these studies as an important contribution to the first phase of the AM effort.

Many lessons were learned from these studies and post study efforts that will help the GLAM Committee as it develops its long-term evaluation strategy and sets priorities. A few of the lessons that have most influenced the priority setting for this first annual work plan are listed below...

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From LOSLR:

- The review of regulation plans for Lake Ontario and the St. Lawrence River has been controversial and difficult to resolve. Opponents to a change in regulation plans continue to focus objections on uncertainties about the science and unknowns related to future climatic and economic conditions. The LOSLR Study and subsequent Government Working Group recognized that adaptive management provides an effective way to address uncertainties through on-going strategic monitoring, analysis and review.
- There are four key environmental performance indicators that have been identified for follow-up from the LOSLR study and post LOSLR efforts and these include: wetland vegetation, bird communities, northern pike, and muskrat. These four performance indicators were identified during the LOSLR Study and subsequent follow-up as being highly significant in terms of representing broad ecosystem response, being sensitive to water level changes, and representing a relatively high degree of scientific certainty.
- There are a number of socio-economic performance indicators that have been identified for follow-up to verify simulated model results, particularly from the Flood and Erosion Prediction System (FEPS) developed and used in the LOSLR Study. Shore protection maintenance was determined to be the performance indicator most sensitive to changes to a regulation plan. The shore protection design height assigned to various geographical locations around the lake were found to be quite sensitive to small changes in the regulation plans. Follow-up monitoring of actual design-height has been identified as a priority for on-going plan evaluation.
- Some follow-up to recreational boating, commercial navigation, municipal infrastructure and hydropower has also been identified from the LOSLR study and post LOSLR efforts for the Lake and River.

IUGLS

- Based on regulation plan formulation and evaluation efforts undertaken in IUGLS, there were only a few performance indicators identified that would be greatly improved or degraded by the Lake Superior regulation plan. Therefore, minimal follow-up of performance indicators is required in the near term, though ongoing assessment of emerging issues may identify additional performance indicators over the longer term. Follow-up analysis is needed to assess the implications on a few performance indicators specific to the St. Marys River area.

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Revision History

Date of next revision:

Revision Date	Previous Revision Date	Summary of Changes	Changes Marked
Sep 10	Aug 10	Reorganized certain tasks, filled-in sections still needing to be completed, deleted tasks that could not be completed this fiscal year, updated table, added a table of available resources	Yes

Approvals

This document requires the following approvals. A signed copy should be placed in the project files.

Name	Signature	Title	Date of Issue	Version
		U.S. Co-Chair, Great Lakes Boards of Control		
Philippe Morel		Canadian Co-Chair, St. Lawrence River Board of Control		
Jaymie Gadal		Canadian Co-Chair, Lake Superior Board of Control		
Aaron Thompson		Canadian Co-Chair, Niagara River Board of Control		

Distribution

This document has been distributed to:

Name	Title	Date of Issue	Version
GLAM Committee members and IJC Liaisons		Aug. 12, 2015	1
GLAM Committee members and IJC Liaisons		Sept. 10, 2015	2
Boards of Control		Sept. 16	3

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APPENDIX – Additional Work Items Considered

ITEMS “On the Fence” Tasks that have been identified as priorities, but are beyond the resources currently available, but which may be candidates for IWI funding

A1. Determine influence of regulation on LO Phragmites

There is some concern that any establishment and expansion of Alien Invasive Species (AIS) within Lake Ontario could have some relationship to the management of water levels and flows. An AIS monitoring program is proposed to monitor the effect of a regulation plan on AIS establishment versus dyked wetlands that are not hydrologically separated from the lake and not influenced by regulation of water levels and flow. Of particular interest is expansion of Phragmites, a common reed (*Phragmites australis*) throughout Lake Ontario. The task would be to develop an AIS monitoring program that would draw on existing programs and expertise in the lower Great Lakes basin and incorporate a suite of control ‘coastal’ wetlands with managed or lost hydrologic connectivity to Lake Ontario (e.g., dyked wetlands or wetlands with permanent barriers). Project elements include: alignment with existing AIS and common reed monitoring programs, accumulation of expertise, study design and field/Geographic Information System (GIS) methodology, and costing. At the moment, the estimated cost is approximately \$150K per year for three years to establish baseline data. On-going requirements need to be determined.

Products:

- The design of an AIS monitoring approach

A2. Develop an Information Management plan

The Information Management Strategy is a framework for successfully managing incoming and outgoing information created, received, or maintained by the GLAM Committee as part of ongoing activities. The Strategy will provide guidance on what might need to be managed and how that management could occur. As part of the initial task, the Strategy will primarily focus on internal information management issues identified by the Committee. A short strategy document will be prepared for review and approval by the Committee. Going forward, the Information Management Strategy will need to align closely with the Communications Strategy to ensure materials prepared by or on behalf of the Committee are made available to the right audiences. As well, there are overlaps with model management efforts. By March 2016, further scoping will be undertaken regarding Information Management requirements as they relate to external communications and the management of large datasets and models used by the Committee.

Products:

- Brief strategy document outlining key Information Management guidance for use by the Committee

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- Initial scoping document for broader Information Management requirements of the Committee including linking with Communications Strategy and the management of models and datasets

List of items considered, but moved to the mid-term strategic plan

- A3. Analyzing Uncertainty in NBS Components
- A3. Improved NBS and Water Level Forecasting
- A5. Conveyance Change Monitoring in the Connecting Channels
- A6. Develop broader understanding of St. Marys hydrodynamics and impacts on stakeholders (IWI)
- A7. Work on navigation PI for Lake Ontario/St. Lawrence/IUGLS
Develop a PI that tracks recreational boating impacts on MH
- A9. Develop a PI that tracks shoreline damages on Lake MH
- A10. White paper discussing stability of dam (St. Marys River)
- A11. Review Whitefish Island flooding in the context of Lake Superior regulation plan formulation and evaluation
- A12. White paper (or discussion paper) about what can be done during high Superior levels (what would you to do reduce damages under extreme high NBS to Lake Superior?)
- A13. Establish Full list of Lesson Learned
- A14. Initial plan for version control of existing tools and models - Assign responsibility for model management
- A15. Develop Peer review process