International Niagara Board of Control

One Hundred Twenty Eighth Semi-Annual Progress Report

to the

International Joint Commission

Covering the Period September 16, 2016 through March 2, 2017*

Executive Summary

Lake Erie began the reporting period with a September mean level 23 cm (9.1 inches) above its 1918–2015 period-of-record, long-term average level for the month. The level of Lake Erie remained above average on a monthly basis throughout the reporting period. The February mean water level was 41 cm (16.1 inches) above average (Section 2).

The level of the Chippawa–Grass Island Pool is regulated under the International Niagara Board of Control's 1993 Directive. The Power Entities (Ontario Power Generation and the New York Power Authority) were able to comply with the Board's Directive at all times during the reporting period. A revision of the 1993 Directive was reviewed and approved by the Board (Section 3).

Planning for the remediation work at the Ashland Avenue gauge continued during this reporting period. An initial design has been carried out which involves extending the intake pipe and stabilizing the bank using Gabion blankets. It is hoped that the design can be finalized in the Spring and construction can be completed by the Fall of 2017 (Section 4).

Flow over Niagara Falls met or exceeded minimum Treaty requirements at all times during the reporting period (Section 5).

No flow measurements were taken during the current reporting period. The next scheduled series of measurements in the Niagara River are planned for May 8-12, 2017 in the American Falls Channel (Section 8).

Review of the test report and proposed new unit rating table for G3 was completed during this reporting period and a new rating table was approved. OPG also continued to carry out its Pump Generating Station reservoir rehabilitation project. The reservoir was drained on April 1, 2016 and the refill process commenced on January 18, 2017. Refilling was

completed, and the reservoir was made commercially available, on February 4, 2017 (Section 9).

Installation of the Lake Erie Ice Boom began on December 17, 2016 and was completed on December 22, 2016. Above average temperatures during the reporting period prevented formation of solid ice cover across Lake Erie. Some work was necessary during the season to repair trailing sections. During this process an unmanned aerial vehicle was successfully used to investigate the potential for using this technology for inspecting the ice boom prior to actual repairs. The members of the International Niagara Working Committee held a teleconference on February 28, 2017 where it was decided that NYPA would begin removal of the ice boom as early as March 6, 2017 (Section 10).

The Board is planning to hold an outreach event with the public in the fall of 2017 in the Niagara area (Section 12).

Membership changes and updates to the Board membership during this reporting period included the following. US Member, Mr. William Allerton, retired on October 25, 2016 and a replacement has not yet been identified. Mr. Bryce Carmichael was appointed as the U.S. Secretary on February 6, 2017 replacing Mr. Arun Heer. Effective February 4, 2017, Mr. Aaron Thompson was reappointed as Canadian Co-Chair for a three-year term ending February 3, 2020 (Section 13).

COVER: View of the American and Canadian Falls in autumn 2016
(Photo Sandrina Rodrigues, Environment and Climate Change Canada)

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* Note that only data available at the time of writing this report is included. Data that was not available during the last reporting period may also be included in this report.

INTERNET SITES

International Joint Commission
www.ijc.org

International Niagara Board of Control
English: ijc.org/en_/inbc
French: ijc.org/fr_/inbc

Lake Erie-Niagara River Ice Boom
www.iceboom.nypa.gov

INTERNATIONAL NIAGARA BOARD OF CONTROL

Cincinnati, Ohio
Burlington, Ontario

March 2, 2017

International Joint Commission
Washington, D.C.
Ottawa, Ontario

Commissioners:

1. General

The International Niagara Board of Control (Board) was established by the International Joint Commission (IJC) in 1953. The Board provides advice to the IJC on matters related to the IJC's responsibilities for water levels and flows in the Niagara River. The Board's main duties are 1) to ensure the operation of the Chippawa-Grass Island Pool (CGIP) upstream of Niagara Falls within the limits of the Board's 1993 Directive, and 2) to oversee the operation of the Lake Erie-Niagara River Ice Boom at the outlet of Lake Erie. The Board also collaborates with the International Niagara Committee (INC), a body created by the 1950 Niagara Diversion Treaty to determine the amount of water available for Niagara Falls and hydroelectric power generation.

The Board is required to submit written reports to the IJC at its semi-annual meetings in the spring and fall of each year. In accordance with this requirement, the Board herewith submits its One Hundred Twenty Eighth Semi-Annual Progress Report, covering the reporting period September 16, 2016 to March 2, 2017.

All elevations in this report are referenced to the International Great Lakes Datum 1985 (IGLD 1985). Values provided are expressed in metric units, with approximate customary units (in parentheses) for information purposes only. Monthly Lake Erie water levels are calculated from four gauges established by the Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data to provide the average level of the lake.

2. Basin Conditions

The level of Lake Erie was above average throughout the reporting period. It began the reporting period with a September mean level at 23 cm (9.1 inches) above its 1918–2015 period-of-record, long-term average level for the month. Between September and December, the lake level fell 22 cm (8.7 inches), which is 5 cm more than the average fall of 17 cm (6.7 inches) for that period. Lake Erie's water level began its seasonal rise two months earlier than normal with its monthly average water level rising 12 cm (4.7 inches) from December to January, when the level typically remains steady. Lake Erie levels ended the reporting period with a February monthly mean water level 41 cm (16.1 inches) above average. Recorded monthly water levels for the period September 2016 through February 2017 are shown in Table 1 and depicted graphically in Figure 1. The following paragraphs provide more detail on the main factors that led to the water level changes observed on Lake Erie during the reporting period.

Table 1: Monthly average Lake Erie water levels based on a network of four water level gauges and the International Great Lakes Datum (1985).

	Metres			Feet		
Month	Recorded* 2016-2017	Average 1918-2015	Departure	Recorded* 2016-2017	Average 1918-2015	Departure
September	174.39	174.16	0.23	572.15	571.39	0.75
October	174.33	174.06	0.27	571.95	571.06	0.89
November	174.26	173.99	0.27	571.72	570.83	0.89
December	174.17	173.99	0.18	571.42	570.83	0.59
January	174.29	173.99	0.30	571.82	570.83	0.99
February	174.40	173.99	0.41	572.18	570.83	1.35

* Provisional

Lake Erie receives water from its local drainage basin and from the upstream lakes. The water supplied to a lake from its local drainage basin is referred to as its net basin supply

(NBS). A lake's NBS is the sum of the amount of water the lake receives from precipitation falling directly on its surface and runoff (including snow melt) from its surrounding land area, minus the amount of water that evaporates from its surface. The sum of Lake Erie's NBS and the inflow from Lake Michigan–Huron via the St. Clair-Detroit Rivers system is its net total supply (NTS).

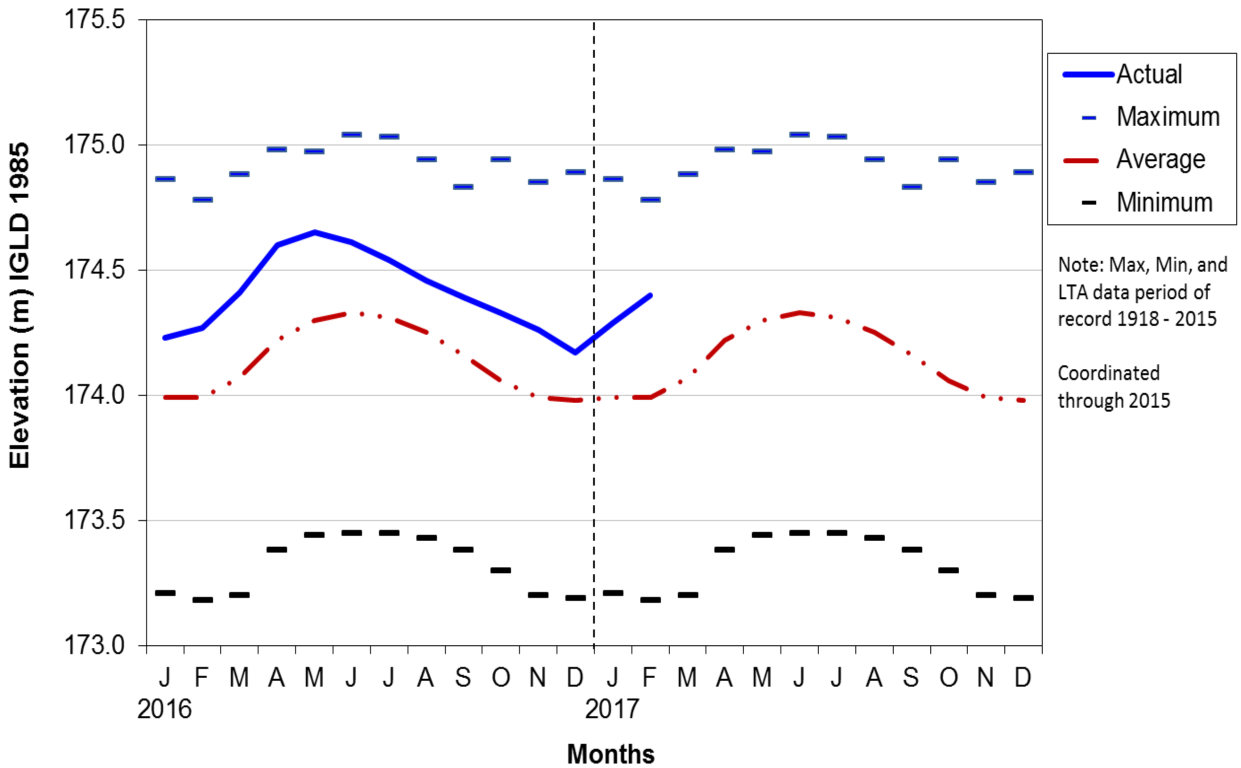


Figure 1: Lake Erie mean monthly and long-term maximum, minimum and average water levels.

Precipitation is a major contributor to NBS, both directly on the lake and through runoff due to rain and snowmelt. Recent precipitation data and departures from the long-term average are shown in Table 2 and depicted graphically in Figure 2. The Lake Erie basin received approximately 39.8 cm (15.7 inches) of precipitation during the period September 2016 through February 2017. This is approximately three percent below the average for the period. Precipitation was above average during the months of September 2016, January and February 2017 and below average for the remaining months.

Table 2: Monthly average precipitation on the Lake Erie basin.

	Centimetres			Inches			
Month	Recorded* 2016-2017	Average 1900-2014	Departure	Recorded* 2016-2017	Average 1900-2014	Departure	Departure (in percent)
September	9.93	8.20	1.73	3.91	3.23	0.68	21
October	6.65	7.21	-0.56	2.62	2.84	-0.22	-8
November	4.47	7.28	-2.81	1.76	2.86	-1.10	-39
December	5.59	6.81	-1.22	2.20	2.68	-0.48	-18
January	8.56	6.34	2.22	3.37	2.50	0.87	35
February	5.44	5.37	0.07	2.14	2.11	0.03	1

* Provisional

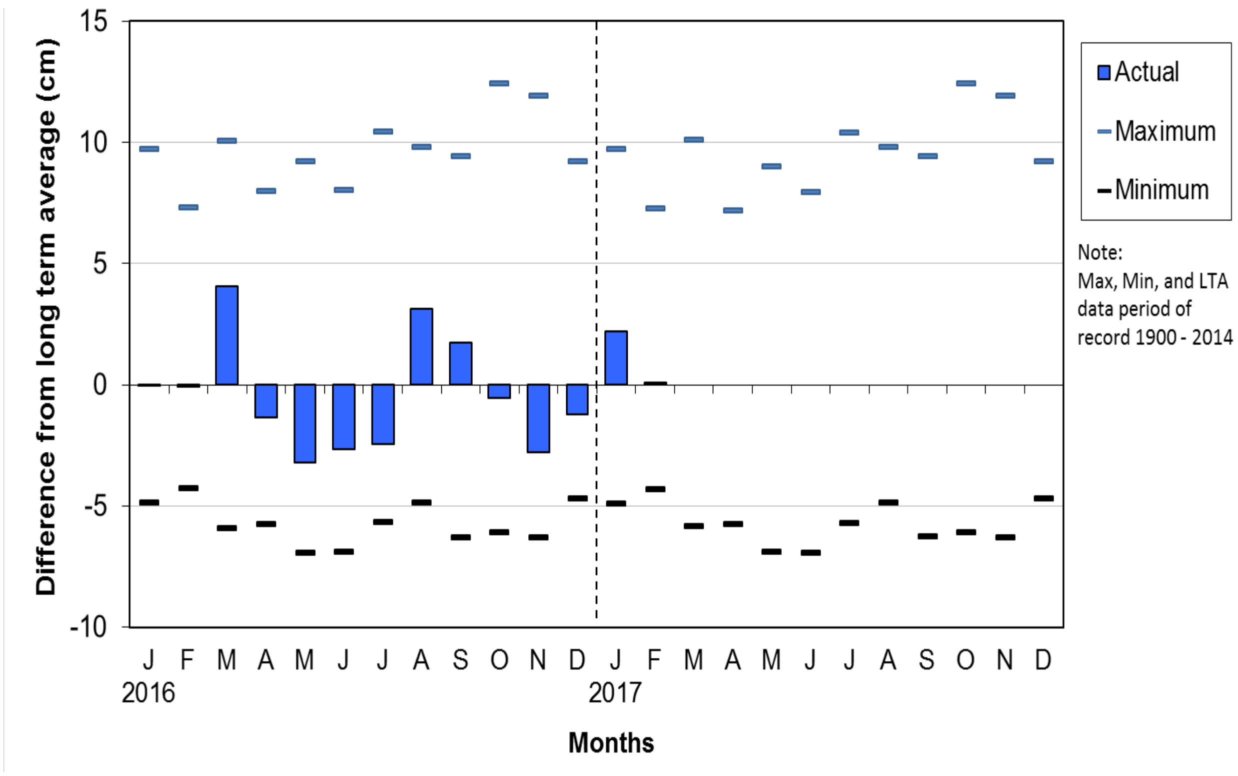


Figure 2: Monthly actual, maximum and minimum precipitation departures from the long-term average on Lake Erie basin.

The recent NBS to Lake Erie is shown relative to average on a monthly basis in Figure 3. A negative NBS value indicates that more water left the lake during the month, due to evaporation, than entered it through precipitation and runoff. On average, this is the case for Lake Erie from August to November. For the remainder of the year, average precipitation and runoff are greater than the water lost to evaporation. During the reporting period, the lake's NBS was above average for September, January and February, close to average for October and December, and below average for November.

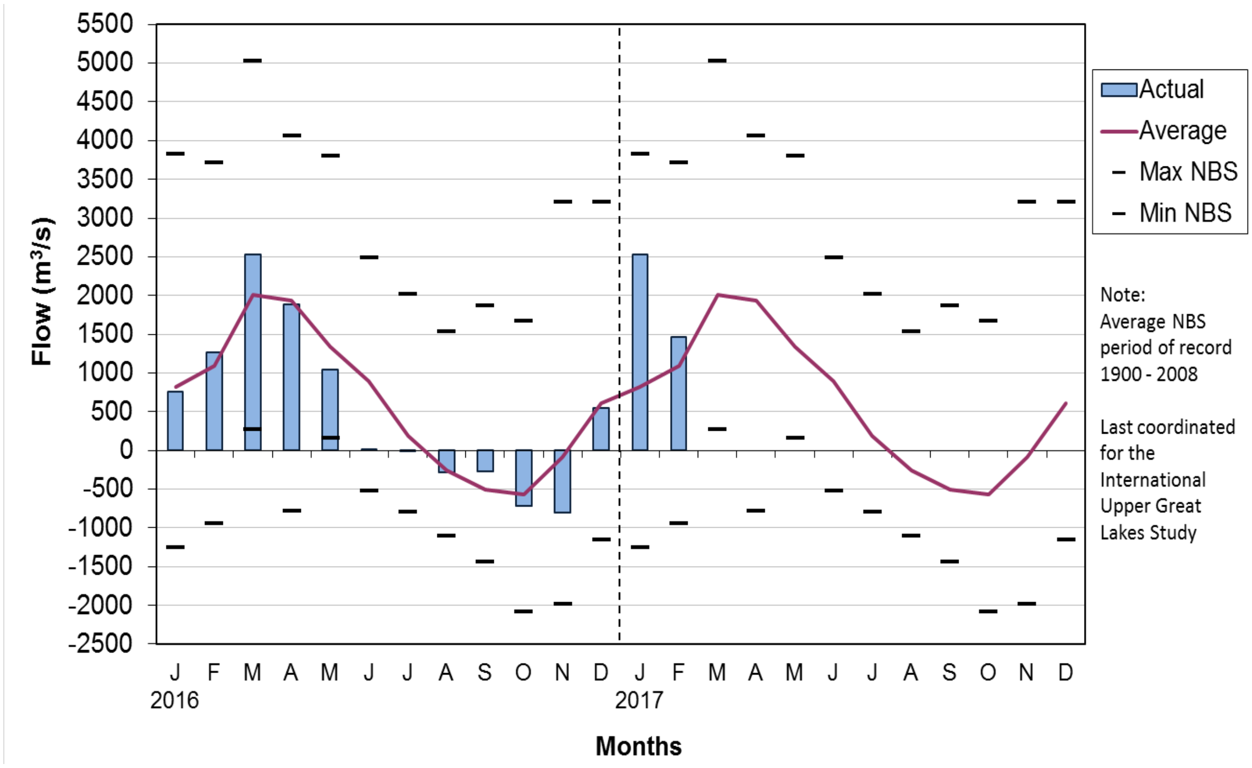


Figure 3: Monthly actual, maximum, minimum and average net basin supplies on Lake Erie basin.

Inflow via the Detroit River is the major portion of Lake Erie's NTS, and is greatly influenced by the level of Lake Michigan–Huron. Continuing the trend of the past year and a half, the level of Lake Michigan-Huron was above average for the entire reporting period (Figure 4). This above average lake level caused the flow in the Detroit River to be above average for the entire reporting period, and in particular, during the months of January and February (Figure 5). As a result, inflow to Lake Erie via the Detroit River was approximately 14 percent above the long-term average from September 2016 to February 2017.

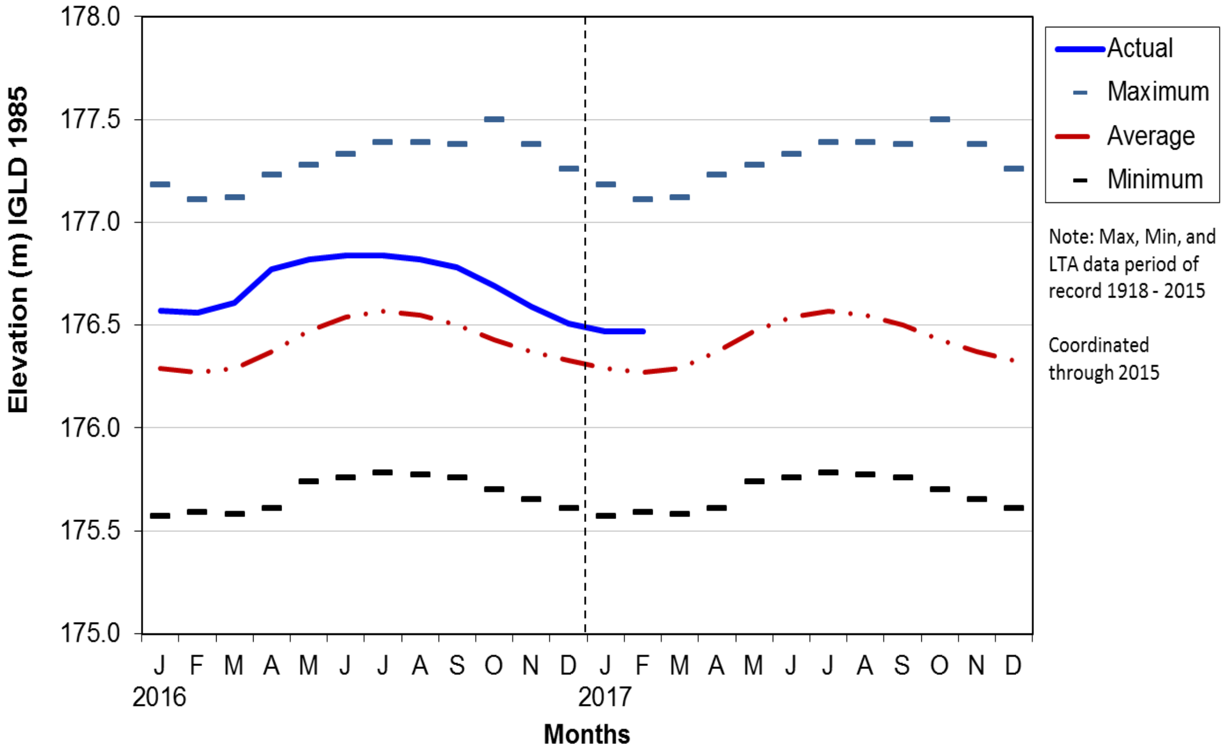


Figure 4: Lake Michigan-Huron mean monthly actual, maximum, minmum and average water levels.

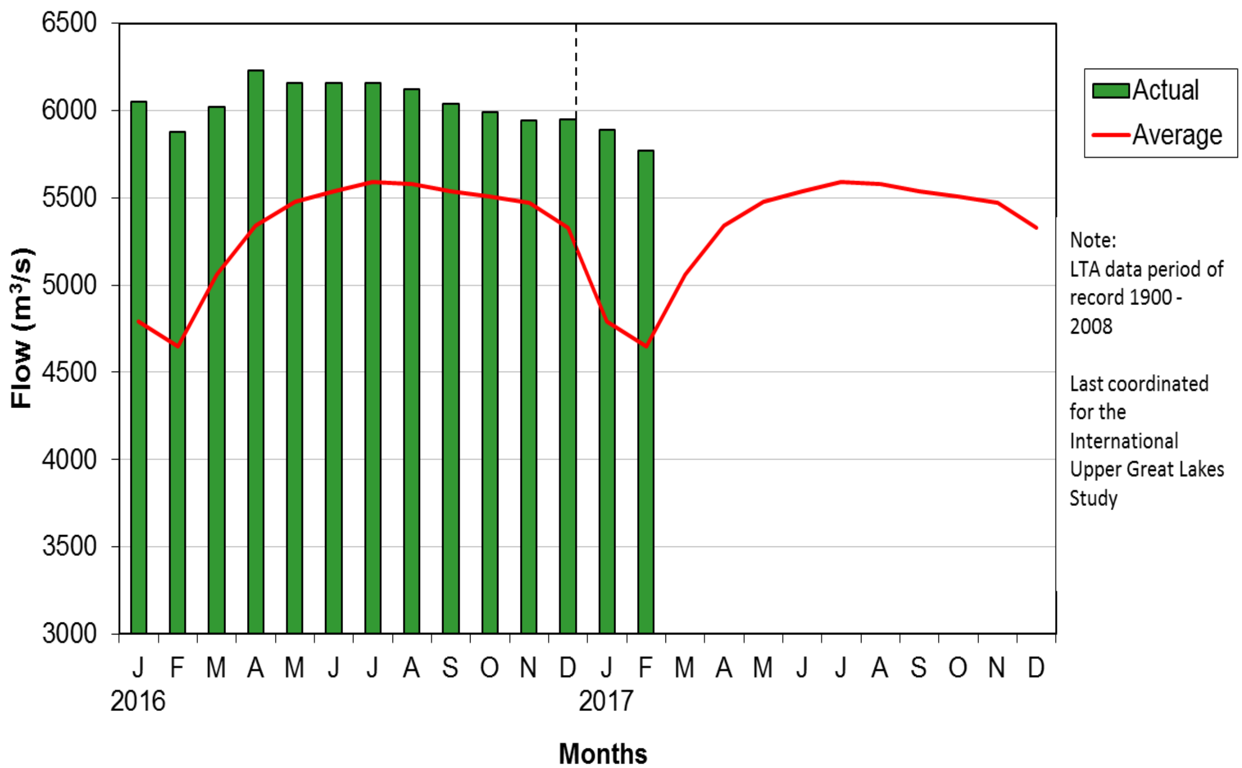


Figure 5: Detroit River mean monthly actual and average flows.

The inflow from Lake Michigan–Huron via the Detroit River combined with Lake Erie's NBS resulted in a NTS for Lake Erie of about 17 percent above average for the period September 2016 through February 2017 (Figure 6). With November as the exception, the NTS were above-average for all months this reporting period. The NTS to Lake Erie for this reporting period is depicted relative to average in Figure 6.

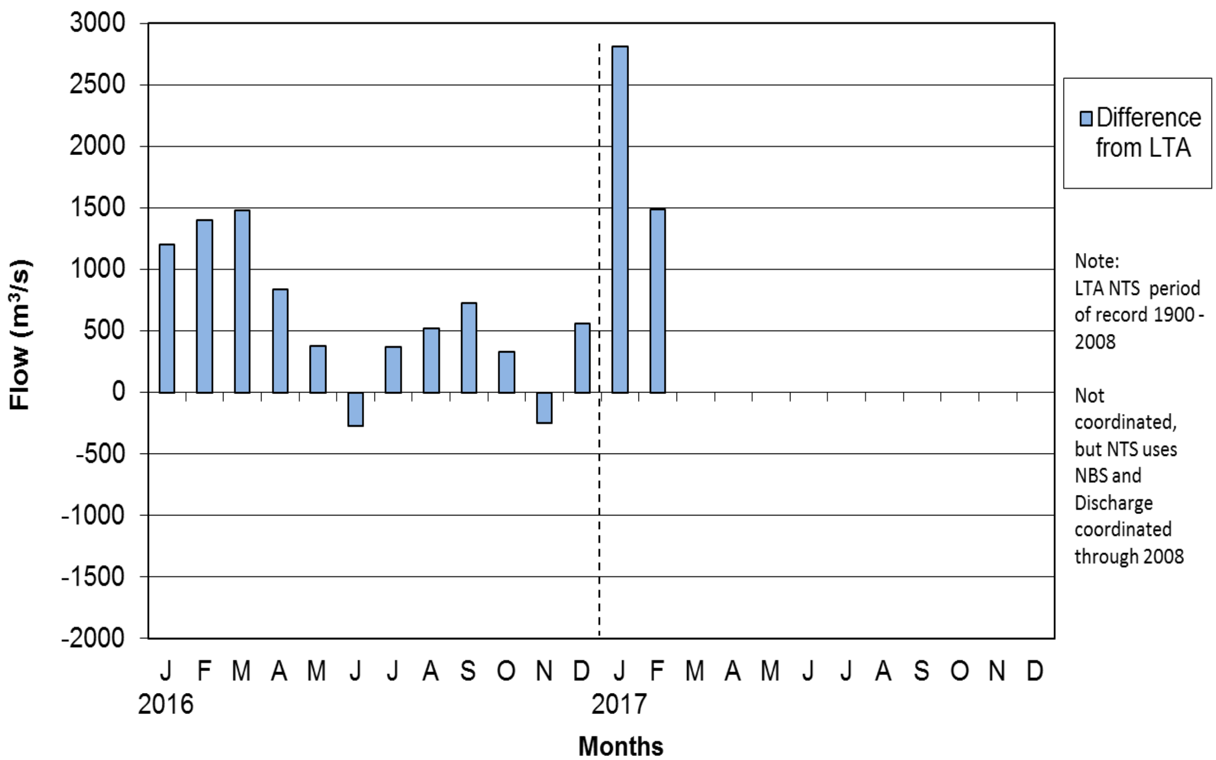


Figure 6: Lake Erie basin monthly net total supplies difference from the long term average.

Lake Erie discharges water to Lake Ontario through the Niagara River and the Welland Canal. The portion of the Lake Erie outflow that is diverted through the Welland Canal is relatively small (between approximately three and five percent of the total Lake Erie outflow) and is used for navigation purposes through the canal and for the generation of electricity at Ontario Power Generation's (OPG's) DeCew Falls hydroelectric plants. Most of the outflow from Lake Erie occurs through the Niagara River and depends on the level of the lake at its outlet. Generally speaking, above-average lake levels result in above-average outflow, and below-average lake levels lead to below-average outflow. Flow in the river is also influenced by winter ice and summer aquatic plant growth in the river, both of which can decrease the flow. Prevailing winds can also cause variations in lake outflow with strong westerly winds raising the level of the lake at the east end resulting in increased outflow and easterly winds having the opposite effect. Throughout the reporting period, Niagara River outflows were well above average with average monthly flows ranging from 6,000 m^3/s to almost 6,600 m^3/s due to above average levels on Lake Erie (Figure 7). Periodic wind events caused a few daily average flows in excess of 7,000 m^3/s, which are not uncommon for this period.

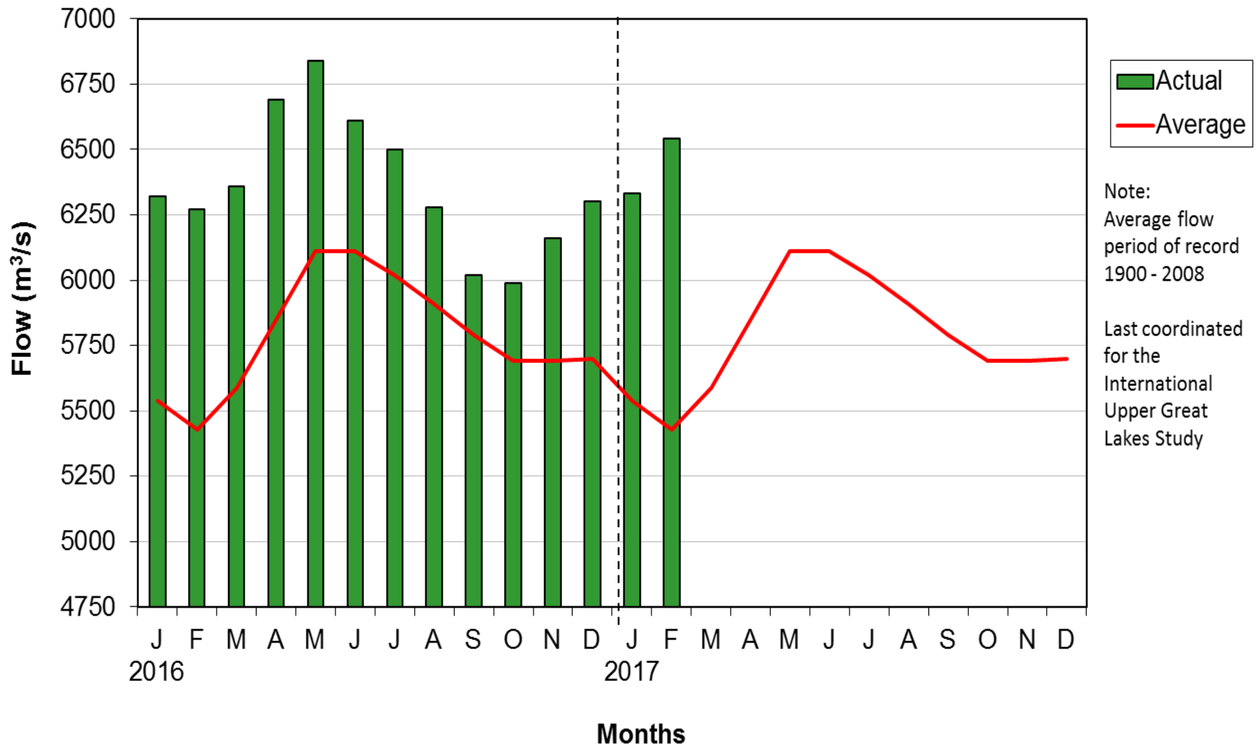


Figure 7: Niagara River mean monthly actual and average flows at Buffalo, New York.

While it is impossible to accurately predict future supplies to the lakes, using historical supplies and the current levels of the lakes, it is possible to estimate future water levels based on past lake levels (1918-present). The six-month water level forecast prepared at the beginning of March by the U.S. Army Corps of Engineers (USACE) and Environment and Climate Change Canada (ECCC) indicates that if average water supply conditions are experienced, the level of Lake Erie would remain above average throughout the spring and summer.

3. Operation and Maintenance of the International Niagara Control Works

The water level in the Chippawa-Grass Island Pool (CGIP) is regulated in accordance with the Board's 1993 Directive. The Directive requires that the Power Entities – Ontario Power Generation (OPG) and the New York Power Authority (NYPA) – operate the International Niagara Control Works (INCW) to ensure the maintenance of an operational long-term average CGIP level of 171.16 m (561.55 feet) to reduce the adverse effects of high or low water levels in the CGIP. The Directive also establishes tolerances for the CGIP's level as measured at the Material Dock gauge.

During the reporting period the 1993 Directive was revised in order to simplify some of the language and rearrange the text to make the intentions of the Directive clearer. This change included improvement of sections for defining tolerances, conditions for suspension of tolerances, and conditions for exclusion of daily data for the calculation of the monthly deviation. The Directive now also includes conditions for suspending tolerances during emergency situations. The revised Directive was reviewed by the International Niagara Working Committee (INWC) and was approved by the Board at the March 2, 2017 meeting.

The Power Entities complied with the Board's Directive at all times during the reporting period.

The accumulated deviation of the CGIP's level from March 1, 1973 through February 28, 2017 was 0.16 metre-months (0.52 foot-months) above the long-term operational average elevation. The accumulated deviation was within the maximum permissible accumulated deviation of ±0.91 metre-months (±3.0 foot-months) for this reporting period.

During the reporting period, tolerances for regulation of the CGIP were suspended due to ice on January 11 and on February 4, 5, 6, 10, 12, 13, 14, 16, and 17.

The locations of the water level gauges on the Niagara River are shown in Enclosure 1. Recorded daily maximum and minimum Material Dock water levels covering the reporting period are shown in Figure 8.

The International Control Dam Bridge Repair Project, which began in the fall of 2014, was completed on November 9, 2016.

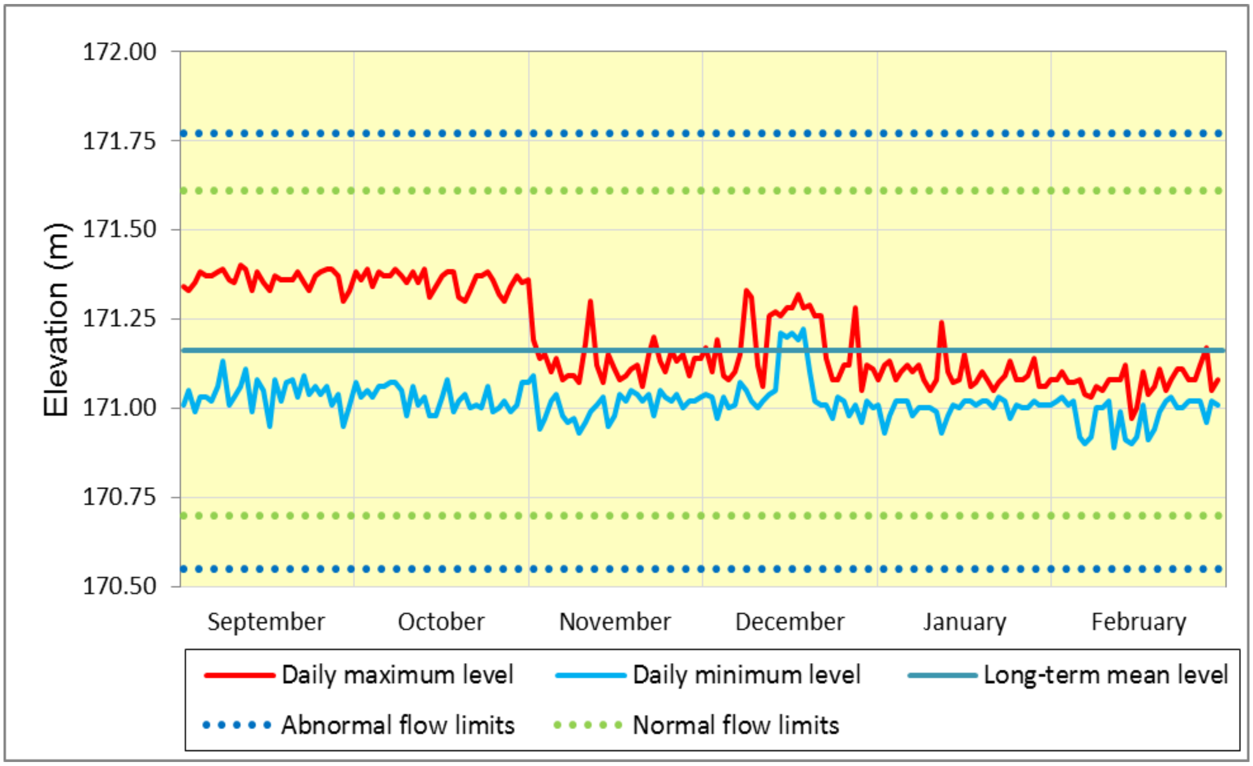


Figure 8: Daily maximum and minimum water levels at Material Dock gauge (September 2016 to February 2017).

4. Gauging Stations

The gauges used to determine flows in the Niagara River, monitor the CGIP levels and the flow over Niagara Falls are the Fort Erie, Material Dock and Ashland Avenue gauges as shown in Enclosure 1. The Buffalo, Slater's Point, and U. S. National Oceanic and Atmospheric Administration (NOAA) Ashland Avenue gauges are used as alternatives in the event of primary gauge failure. The Slater's Point and Material Dock gauges are owned and operated by the Power Entities. Both NOAA and the Power Entities own and operate water level gauges at the Ashland Avenue location. All gauges required for the operation of the INCW were in service during this reporting period, except for short periods on October 19, October 26, November 10 and November 16, 2016 due to unavailability of the Ashland Avenue gauge. The above mentioned backup gauge was used so that no gaps in gauge data occurred.

Planning for remediation work at the Ashland Avenue Gauge, which is used to determine flow over the Falls for purposes of the 1950 Niagara Diversion Treaty, continued during this reporting period with the presentation of a conceptual design. This design involves extending the existing pipe from the gauge house a further 2 m (6 ft) into the river channel and placement of gabion stone mattresses to stabilize the shoreline band and support the inlet pipe extension. It also proposes putting an elbow at the end of the pipe extending downstream to prevent sediment deposition from upstream. The proposed design is anticipated to mitigate against infilling of the gauge inlet by providing more natural scouring of river bed material away from the inlet. The current configuration of the pipe requires regular maintenance to keep the end of the pipe sediment free.

The proposed timeline by the Power Entities is to finalize the design in spring 2017 with the contract awarded in the early fall in anticipation of construction beginning November 2017.

Efforts to find a viable backup to the Ashland Avenue site remain ongoing. Currently, a list of Falls flow measurement alternatives are being compiled by the INWC, in case of a large scale failure of the Ashland Avenue gauge. Once the list is compiled these options can be evaluated.

5. Flow over Niagara Falls

The Niagara Diversion Treaty of 1950 sets minimum limits on the flow of water over Niagara Falls. During the tourist season (April-October) day time hours, the required minimum Niagara Falls flow is 2,832 cubic metres per second (m^3/s) (100,000 cubic feet per second (cfs)). At night and at all times during the non-tourist season months (November-March), the required minimum Falls flow is 1,416 m^3/s (50,000 cfs). The appropriate operation of the INCW, in conjunction with power diversion operations, maintains sufficient flow over the Falls to meet the requirements of the 1950 Niagara Diversion Treaty. Falls flow met or exceeded minimum Treaty requirements at all times during the reporting period. The recorded daily average flow over Niagara Falls, covering the period September 2016 through February 2017, is shown in Figure 9.

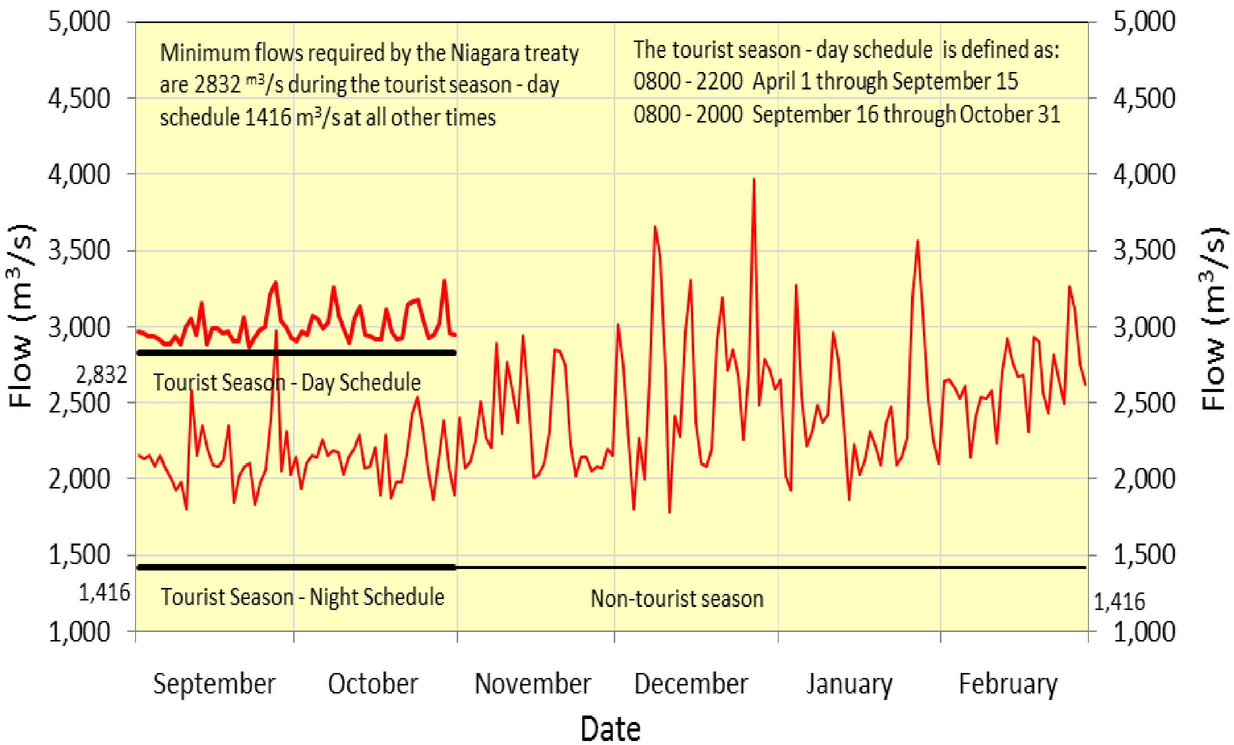


Figure 9: Daily flow over Niagara Falls from September 2016 through February 2017 (flow at Ashland Avenue in m^3/s).

6. Falls Recession

The Board monitors the Horseshoe Falls for changes in its crestline. Crestline changes may result in a broken curtain of water which could change the scenic value of the Falls. Changes in the crestline could also form a notch which could signal a period of rapid Falls recession that has not been seen in more than a century. A review of the falls crest imagery (most recent image found at time of writing the report was taken on February 18, 2017) showed no evidence of notable change in the crestline of the Falls during this reporting period.

7. Diversions and Flow at Queenston

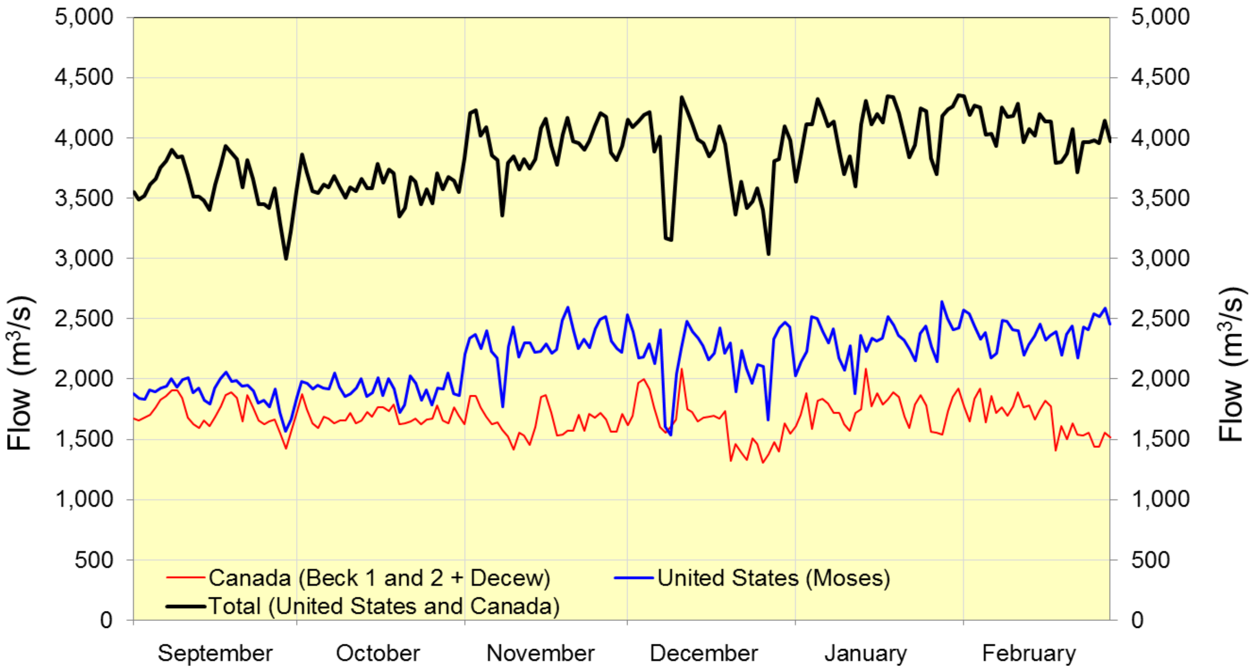
Diversion of water from the Niagara River for power purposes is governed by the terms and conditions of the 1950 Niagara Diversion Treaty. The Treaty prohibits the diversion of Niagara River water that would reduce the flow over Niagara Falls for scenic purposes to below the amounts specified previously in Section 5 of this report.

The hydroelectric power plants, OPG's Sir Adam Beck (SAB) I and II in Canada and NYPA's Robert Moses Niagara Power Project in the United States, withdraw water from the CGIP upstream of Niagara Falls and discharge it into the Lower Niagara River at Queenston, ON and Lewiston, NY, respectively. During the period of September 2016 through February 2017, diversion for the SAB I and II plants averaged 1,542 m^3/s (54,460 cfs) and diversion to the Robert Moses Niagara Power Project averaged 2,167 m^3/s (76,530 cfs).

The average flow from Lake Erie to the Welland Canal for the period September 2016 through February 2017 was 187 m^3/s (6,597 cfs). Diversion from the canal to OPG's DeCew Falls Generating Stations averaged 140.0 m^3/s (4,940 cfs) for the same period of time.

Records of diversions for power generation covering the period September 2016 through February 2017 are shown in Figure 10.

The monthly average Niagara River flow at Queenston, Ontario, for the period of September 2016 through February 2017, and departures from the 1900–2015 long-term average are shown in Table 3. Maximum and minimum monthly average flows for the 1900–2015 period of record are shown in Table 4. During the period September 2016 through February 2017, the flow at Queenston averaged 6,243 m^3/s (220,470 cfs), which was 619 m^3/s (11, 390 cfs) above the 1900-2015 average of 5,623 m^3/s (209,060 cfs) for the period. The monthly values ranged between 5,994 m^3/s (211,680 cfs) and 6,577 m^3/s (232,260 cfs).



Note: For purposes of the Niagara treaty, the Canadian diversion includes water diverted from the Niagara River and water diverted through the Welland ship canal for power purposes

Figure 10: Daily diversion of Niagara River water for power purposes (September 2016 through February 2017).

Table 3: Monthly Niagara River flows at Queenston.

	Cubic Metres per Second			Cubic Feet per Second		
Month	Recorded 2016-2017	Average 1900-2015	Departure	Recorded 2016-2017	Average 1900-2015	Departure
September	6004	5727	277	212,030	202,140	9,780
October	5994	5650	344	211,680	199,420	12,150
November	6177	5666	511	218,140	199,950	18,050
December	6324	5704	620	223,330	201,220	21,900
January	6379	5551	828	225,270	196,030	29,240
February	6577	5442	1135	232,260	192,180	40,080
Average	6243	5623	619	220,470	198,570	21,900

Table 4: Monthly maximum and minimum Niagara River flows at Queenston.

	Maximum Flows			Minimum Flows		
Month	Year	m^3/s	ft^3/s	Year	m^3/s	ft^3/s
September	1986	6880	242,960	1934	4340	153,270
October	1986	7220	254,970	1934	4320	152,560
November	1986	7030	248,260	1934	4190	147,970
December	1985	7410	261,680	1964	4270	150,790
January	1987	7420	255,680	1964	3960	139,850
February	1987	6900	243,670	1936	3320	117,240

8. Flow Measurements in the Niagara River and Welland Canal

Discharge measurements are regularly scheduled in the Niagara River and Welland Canal as part of a program to verify the gauge ratings used to determine flow in these channels for water management purposes. Measurements are obtained through joint efforts of the USACE and ECCC. Measurement programs require boats, equipment and personnel from both agencies to ensure safety, quality assurance checks between equipment and methods, and bi-national acceptance of the data collected. The USACE and ECCC continue efforts to standardize measurement equipment and techniques. Historically, measurements were made at several locations as described below. No measurements were taken during the current reporting period.

Upper Niagara River: Regularly scheduled measurements are taken near the International Railway Bridge, located in the upper Niagara River, on a three-year cycle to provide information for evaluating stage-discharge relationships for flow entering the Niagara River from Lake Erie. The regularly scheduled discharge measurements near the International Railway Bridge were taken in May 2015. The next measurements are scheduled for 2018.

ECCC is also taking continuous water level measurements from a gauge at a proposed International Gauging Station located near the International Railway Bridge discharge measurement section. Flow measurements were taken throughout 2013 and 2014 to observe the seasonal impact of aquatic plant growth on flow. ECCC will use continuous acoustic velocity meter data to assist with assessing flow conditions under ice during the winter and during periods affected by aquatic plant growth. Continuous daily discharge data during non-ice affected periods is being published by both ECCC and USGS through their respective web sites.

Lower Niagara River: The Ashland Avenue gauge rating (AAGR) is used to determine the flow over Niagara Falls for purposes of the 1950 Niagara Diversion Treaty. Discharge measurements are made on a three-year cycle at the AAGR section, located just upstream of the OPG and NYPA hydroelectric generating stations at Queenston–Lewiston, to verify the 2009 Ashland Avenue gauge rating of the outflow from the Maid-of-the-Mist Pool below the Falls. A suite of discharge measurements ranging between 1,902 m^3/s and 3,526 m^3/s were obtained between May 24 and May 27, 2016. Due to above average river flows and power system conditions experienced in both Ontario and New York at the time, the lowest targeted flow of 1,416 m^3/s could not be provided for measurement. The results of the discharge measurements have been analyzed and documented in a draft report prepared by the Great Lakes Hydraulics and Hydrology Office, USACE, Detroit District and Meteorological Service of Canada, Ontario Region, ECCC. The 2016 discharge measurements were all within five percent of the flows computed using the 2009 Ashland Avenue rating equation and also consistent with previous acoustic Doppler current profiler (ADCP) measurements made at the section since 2001 verifying the accuracy of the current falls flow measurement. The next measurement series is scheduled for 2019. However, due to the importance of flow measurements at 1,416 m^3/s, additional flow measurement may be attempted at this flow before 2019 if Niagara River conditions and operations allow.

In addition to the measurements at the AAGR section, measurements of total flow in the Niagara River are periodically made downstream of the OPG and NYPA hydroelectric generating stations at Queenston–Lewiston during run-of-river conditions. This section is located approximately 1.6 kilometers (1 mile) upstream of the Stella Niagara section, where conventional measurements have been made. Each measurement of total flow is compared to the sum of the outflow from the Maid-of-the-Mist Pool (flow over Niagara Falls) and the discharges from the hydroelectric generating stations to verify these measurements. The results are compared to turbine ratings and the summation of flow calculations to validate flow measurements being used for Treaty purposes. Brief summaries of these measurements are included in the report "Discharge Measurements on the Niagara River near the Cableway Section, 2013/2014: For Verification of the Ashland Avenue Gauge Rating For the Maid-of-the-Mist Pool Outflow, August 2015".

American Falls Channel: Discharge measurements are made in the American Falls Channel on a five-year cycle to verify the rating equation used to determine the amount of flow in the American Falls channel and to demonstrate that a dependable and adequate flow of water is maintained over the American Falls and in the vicinity of Three Sisters Islands as required by the IJC Directive to the Board. Measurements are made using a section in the upper reach of the American Falls channel near the American Falls Gauge site. In May 2012, measurements confirmed that there was no difference between measured flows and flows computed using the present American Falls rating equation. Following the five-year cycle, the next scheduled measurements at this location are scheduled for May 8-12, 2017.

Welland Canal: Discharge measurements are made on a three-year cycle in the Welland Supply Canal above Weir 8 to verify the index-velocity rating used to determine flow through the Welland Canal. Measurements were made in the Welland Supply Canal in May 2012 to re-set the measurement interval. Off-schedule measurements and field work in 2013 provided baseline validation data for a second, duplicate, acoustic Doppler velocity meter (ADVM) system, together with confirming the validity of the 2007-2012 index velocity rating at the original site. A series of measurements were obtained in the Welland Supply Canal in May 2015 to verify the discharge equations for both ADVM systems.

Results from this measurement series are still under review. The next measurement series will take place in 2018.

9. Power Plant Upgrades

OPG began a unit rehabilitation program in 2007 for a number of its Beck I units— G3, G7, G9 and G10. The upgrades of G3, G7, and G9 have been completed, with new unit rating tables issued for G7 and G9 during previous reporting periods. Review of the test report and proposed new unit rating table for G3 was completed during this reporting period. The new rating table has been approved, and will be placed into service in early March. Beck unit G10 went out of service on September 13, 2015 for rehabilitation (new runner and generator rewind) and is expected to return to service in mid-2017.

An overhaul of G2 at the DeCew Falls generating station began in November 2016. The unit is expected to remain out of service until February 2018.

OPG continued to carry out its Pump Generating Station (PGS) reservoir rehabilitation project during the reporting period. In order to ensure long term safety, remedial measures (e.g. liner installation and grout curtain construction) were implemented proactively by OPG to guard against any potential piping failures through the dyke foundation in the future. The reservoir was drained on April 1, 2016 and the refill process commenced on January 18, 2017. Refilling was completed, and the reservoir was made commercially available, on February 4, 2017. The PGS supports OPG's SAB plants in efficiently using Canada's diversion entitlement for power production. These maintenance activities did not have an impact on regulation of the CGIP, which is governed by the Board's 1993 Directive.

NYPA did not undertake significant upgrades to their power plant during this reporting period.

10. Ice Conditions and Ice Boom Operation

Preparations for installing the Lake Erie–Niagara River ice boom began in late November. From November 28 to December 6, 2016, the junction plates were raised from the bottom of the lake, and floatation buoy barrels were attached. The strings of boom pontoons were pulled from their summer storage area and placed inside the Buffalo Harbor breakwall during the period December 7-14, 2016.

In accordance with Condition (d) of the Commission's October 5, 1999 supplementary Order of Approval, installation of the ice boom may begin when the Lake Erie water temperature, as measured at the Buffalo Water Intake, reaches 4ºC (39ºF) or on December 16, whichever occurs first. Although both conditions were met on December 16, due to high waves on Lake Erie, installation of the 22 ice boom spans began on December 17, 2016. Seven spans of the boom were put in place on December 17, starting from the Canadian side. High winds and waves slowed the progress of installation, with the remaining 15 spans being put into place over the next five days, as weather permitted. The final spans were installed on December 22, completing the ice boom's installation for the 2016–17 ice season.

A practice drill for NYPA's Flood Warning Notification Plan in the Event of Ice Affected Flooding on the Upper Niagara River was conducted on December 20, 2016. This year's drill simulated a flood event along the U.S. shore of the Niagara River due to an ice blockage between the NYPA intakes and the Buckhorn Dykes, causing rising water levels at the LaSalle Yacht Club Gauge Station and flooding on the Niagara Scenic Parkway beneath the North Grand Island Bridge. The simulation included a practice "Flood Watch" which was escalated to a "Flood Warning".

Weekly reports on the ice conditions for Lake Erie and the Niagara River were prepared and submitted to the Board by the Power Entities beginning on December 3, 2016.

With the onset of colder weather in January, water temperatures in the CGIP decreased from 2.35 to 0.9ºC from January 5 to January 7, 2017. Throughout January, thin sheets of shale ice moved past the intakes. On January 11 and February 4 sheets of ice partially blocked the NYPA intakes and ice procedures were used to clear the stoppages.

After a report of a trailing span on January 17, 2017, an unmanned aerial vehicle was used on January 19, 2017 to investigate the potential for using this technology for inspecting the ice boom prior to actual repairs. The results proved to be beneficial in determining the extent of damage and identifying the components required for repairs. On January 20, span “L” was repaired and three additional buoy barrels were confirmed missing. These buoy barrels were replaced on January 25. On February 12, 2017, span ‘E’ was observed to be trailing and it was repaired on February 17, 2017.

Lake Erie ice conditions for the 2016-2017 ice season started with above average ice cover due to a few short cold spells in late December and mid-January. However unseasonably warm temperatures in January and February resulted in below average Lake Erie ice cover. Data jointly compiled by the Canadian Ice Centre and the U.S. National Ice Center of weekly ice coverage for Lake Erie is shown in Figure 11.

Given the lack of ice, the two helicopter flights typically carried out in late winter to measure ice thickness on the eastern part of Lake Erie were not scheduled at the end of this reporting period. Review of available moderate resolution imaging spectroradiometer (MODIS) imagery and ground-based observations indicated that there was open water at all of the six standard measurement sites. Similarly, the fixed-wing flights normally scheduled to determine the extent and condition of the ice cover in order to decide when the ice boom can be removed were not required in this reporting period.

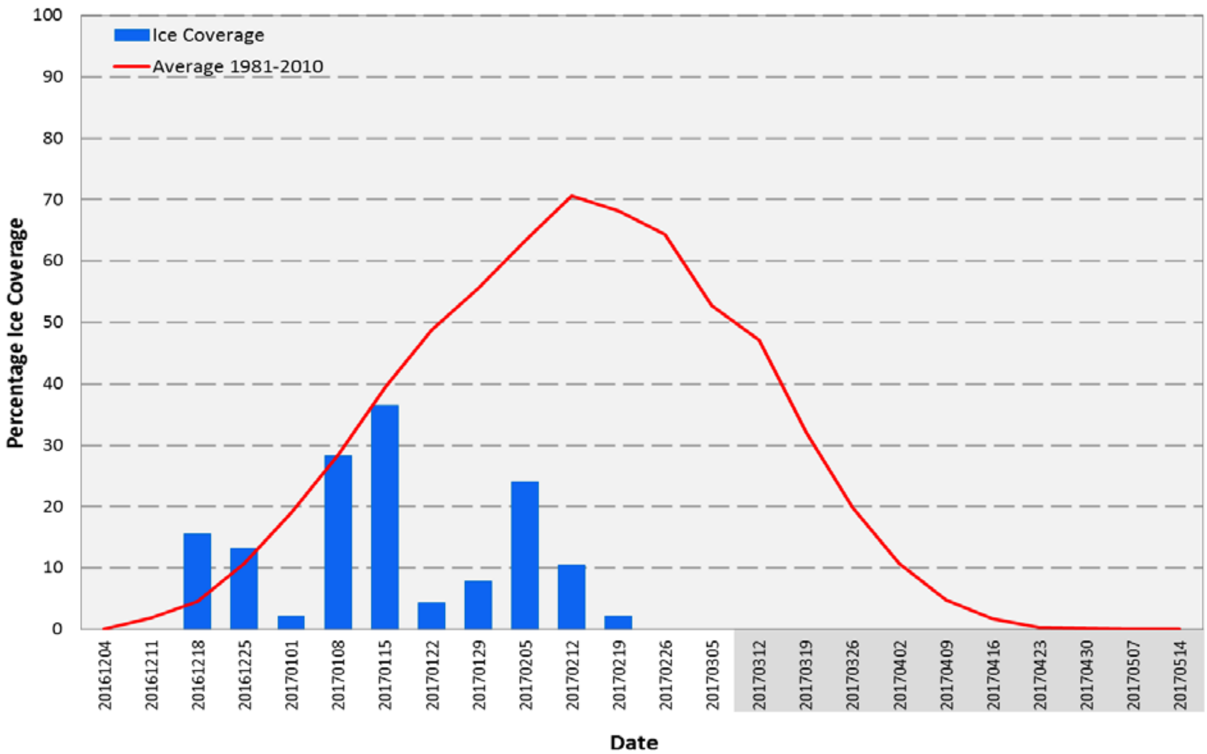


Figure 11: Weeky ice coverage for Lake Erie during the 2016-17 ice season up to March 6, 2017 (Note that dates shown in gray were outside the reporting peroid).

To the end of this reporting period, intermittent ice formed in short cold periods in some areas of Lake Erie, but for the most part above average temperatures prevented solid ice formation immediately upstream of the Lake Erie-Niagara River Ice Boom. The members of the INWC held a teleconference on February 28, 2017. Due to the lack of ice cover in the Niagara River and on Lake Erie, along with a relatively warm weather forecast, it was decided that NYPA would prepare to begin removal of the ice boom as early as March 6, 2017, subject to operational and safe working conditions.

In response to public concern on ice boom operations, regular updates were provided on the Board's website at ijc.org/en_/inbc/ice_boom.

11. Other Issues

American Falls Bridges Project: New York State Parks (NYSP) has examined the existing structure conditions and possible rehabilitation and replacement options over the past years for the two pedestrian bridges crossing the American Falls Channel from Prospect Park to Green Island and from Green Island to Goat Island. Further details can be found in the 127th INBC Semi-Annual Report. Phase 1, the planning and scoping phase, was completed in the Fall of 2013, while the second phase, preliminary design phase, was completed in the Fall of 2014. The INWC was actively involved in the development and review of the base hydraulic model for this project and the available alternatives. The model that was originally prepared for this project did not include any analysis on how the temporary closure of the American Falls channel would affect the operation of the Niagara River Control Works and these comments have been provided to NYSP. In a letter dated February 26, 2016, the IJC expressed concern about how the levels in the CGIP would be maintained in accordance with the Board's 1993 Directive (as revised) during construction. A letter was sent to the IJC on October 20, 2016 stating that the NYSP indefinitely suspended any further work on the American Falls Bridges project in April 2016 due to funding constraints. No additional information has been provided to the INWC as to when the project will be reinstated. The Board and the INWC remain committed to providing a thorough technical review of the models to ensure that the operation of the Control Works and the CGIP are properly captured. The Board has requested to be kept informed if plans for construction are resumed, and the Board will inform the IJC of any changes as information is received.

12. Meeting with the Public

In accordance with the Commission's requirements, the Board will hold an outreach event with the public in the fall of 2017 in the Niagara area. Initial discussions are underway to possibly present information at the Erie County Fair held annually in the Buffalo area in mid-August. This is a different approach than used in the past and it is hoped this will increase the number of members of the public that attend.

13. Membership of the Board and the Working Committee

Changes and reappointments to the Board membership this reporting period are as follows. The US Member of the Board, Mr. William Allerton, retired on October 25, 2016 and a replacement has not yet been identified. Mr. Bryce Carmichael was appointed as the U.S. Secretary on February 6, 2017 replacing Mr. Arun Heer who remains as U.S. Secretary to other IJC Boards. Effective February 4, 2017, Mr. Aaron Thompson was reappointed as Canadian Co-Chair for a three-year term ending February 3, 2020.

14. Attendance at Board Meetings

The Board met once during this reporting period. The meeting was held on March 2, 2017 at the US Army Corps of Engineers Great Lakes and Ohio River Division office, Cincinnati, Ohio. Mr. Stephen Durrett, U.S. Alternate Section Chair was present in Cincinnati and Mr. Aaron Thompson, Canadian Section Chair, participated by video-conference.

Original Signed By	*Original Signed By*
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Mr. AARON F. THOMPSON Chair, Canadian Section	BG MARK R. TOY Chair, United States Section

Original Signed By	*Original Signed By*
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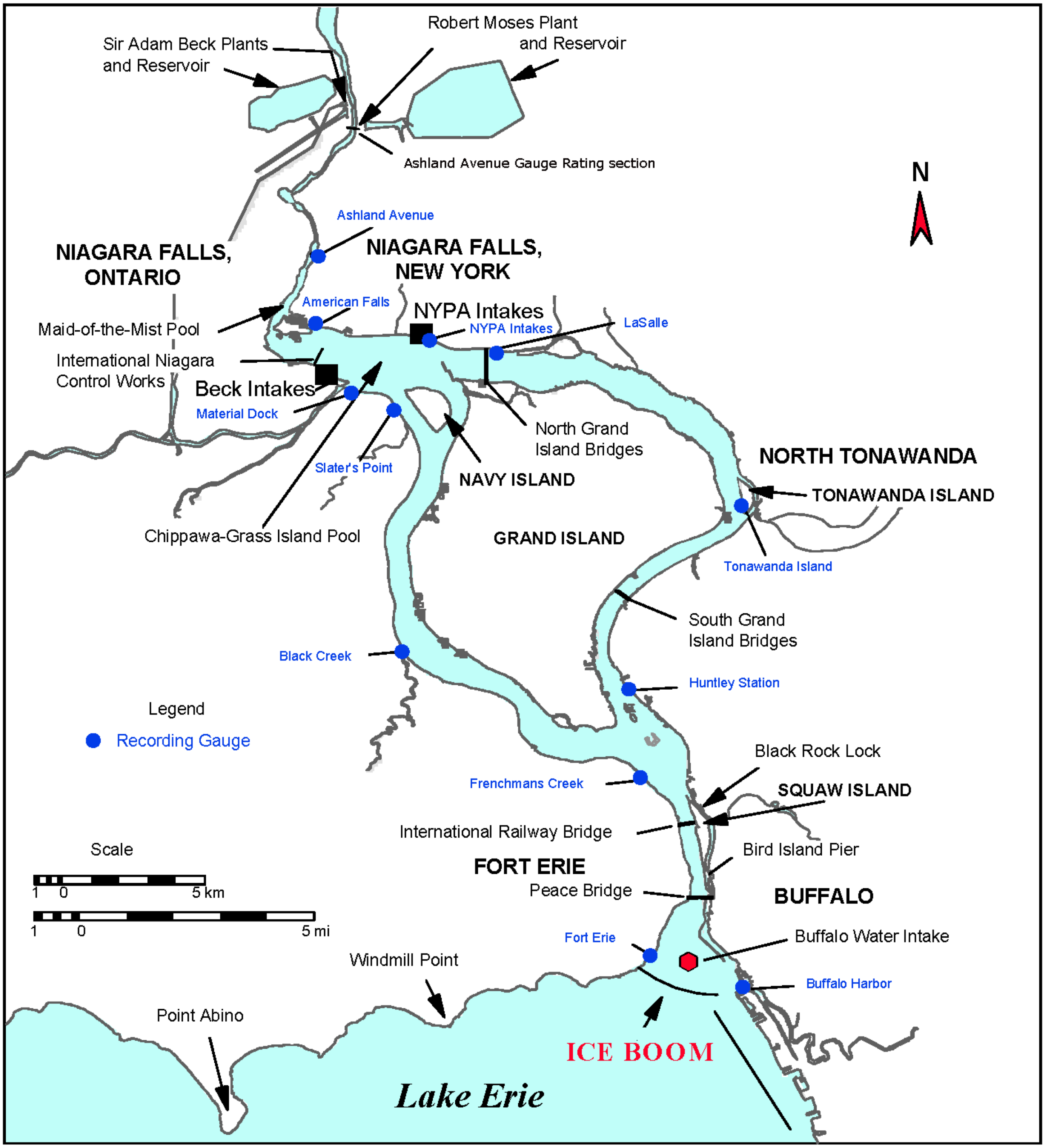
Ms. JENNIFER L. KEYES Member, Canadian Section	VACANT Member, United States Section



Enclosure 1: Map of the upper Niagara River showing water level gauge locations.