International Niagara Board of Control

One Hundred Sixteenth Semi-Annual Progress Report

to the

International Joint Commission

Covering the Period September 16, 2010 through March 22, 2011

EXECUTIVE SUMMARY

The level of Lake Erie began the reporting period 14 centimetres (5.5 inches) below the long-term average for the month of September, and remained below average up until the very end of the reporting period. Above average precipitation during late February and early March caused levels to climb to average by the end of the reporting period.

Inflows to Lake Erie from upstream, via the Detroit River, were below the long-term average during the reporting period. This was largely due to the level of Lakes Michigan and Huron continuing to be well below long-term average. However, the inflow to Lake Erie was also affected by ice jams in the St. Clair River during January and late February. Although the March 2011 six-month water level forecast indicates that the level of Lake Erie is expected to continue to be below its long-term average at least through mid-summer, the lake's rise to average increased the possibility of average or above-average conditions into the summer (Section 2).

The level of the Chippawa-Grass Island Pool was 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 (Section 3).

Use of the cableway, located just upstream of the OPG and NYPA plants, for the Board's flow measurement program has become redundant. The New York Power Authority, on behalf of the Power Entities, has undertaken to have the cableway removed (Section 7).

Ontario Power Generation continues with construction of the Niagara Tunnel Project. By March 20, the Tunnel Boring Machine (TBM) had progressed 10089 metres (33,100 feet) 99% of the total length (Section 8).

Installation of the Lake Erie-Niagara River Ice Boom began on December 14 and was completed on December 16 (Section 9).

The Board will hold a meeting with the public in September 2011 in the Niagara Falls, Ontario area (Section 10).

COVER: **Ice build-up in the Maid-of-the-Mist Pool below Niagara Falls. (U.S. Army Corp of Engineers Buffalo District photo).**

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INTERNET SITES

International Joint Commission
www.ijc.org

International Niagara Board of Control
www.ijc.org/conseil_board/niagara/en/niagara_home_accueil.htm
www.ijc.org/conseil_board/niagara/fr/niagara_home_accueil.htm

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

INTERNATIONAL NIAGARA BOARD OF CONTROL

Chicago, Illinois
Burlington, Ontario

March 22, 2011

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

Commissioners:

1. GENERAL

The International Niagara Board of Control (Board) submits its One Hundred Sixteenth Semi-Annual Progress Report, covering the reporting period September 16, 2010 through March 22, 2011.

2. LAKE LEVELS

All elevations in this report are referenced to International Great Lakes Datum 1985 (IGLD 1985). The values are expressed in metric units, with approximate customary units (in parentheses) for information purposes only. The monthly lake level data are based on a network of four gauges to better represent the average level of the lake.

The level of Lake Erie began the reporting period 14 centimetres (5.5 inches) below the long-term average for the month of September, and remained below average up until the very end of the reporting period. The lake's level experienced a larger-than-average decline during September through February and as a result the lake's February monthly level was 24 centimeters (9.4 inches) below the long-term average. However, precipitation

amounts well-above average during the last week of February and the first three weeks of March resulted in a significant rise in the lake's level. As a result, the lake's level was at average at the end of the reporting period. Recorded water level data for the period September 2010 through February 2011 and departures from long-term averages are shown in Table 1 and depicted graphically in Figure 1.

Precipitation on the Lake Erie basin was below average for each month of the reporting period except November and February. Precipitation in February was nearly twice the average for the month, with a large portion of the precipitation occurring during the last week of the month. As noted above, the lake also received precipitation amounts well-above average during the portion of March covered by the reporting period. During the period September 2010 - February 2011, the basin received approximately 44 centimetres (17.3 inches) of precipitation. This is about 7% above the average of 41 centimetres (16.1 inches) for the time of year. Recent precipitation data and departures from long-term averages are shown in Table 2 and depicted graphically in Figure 2.

Water supplied to Lake Erie from its local drainage basin (net basin supply) reflects the amount of precipitation the basin receives during the reporting period, as well as evaporation from the land and lake surfaces and snow accumulation and melt. The net basin supply to Lake Erie was generally below average during the reporting period, though slightly above average in February. Recent net basin supplies are depicted in Figure 3.

Inflows to Lake Erie from upstream, via the Detroit River, were below the long-term average during the reporting period. This was largely due to the level of Lakes Michigan and Huron continuing to be well below its long-term average. In January and February the Detroit River flow was also impacted by ice retardation on the St. Clair River.

The water level of Lake Erie naturally affects the outflow into the Niagara River, as does the amount of flow retardation in the river due to ice and weeds. Like the level of Lake Erie, the Niagara River flow was below average for every month of the reporting period.

The monthly flow in the Niagara River is graphically depicted in Figure 4 and summarized in Section 5.

The March 2011 six-month water level forecast, produced at the beginning of March, indicates that the level of Lake Erie is expected to continue to be below its long-term average at least through mid-summer. However, the lake's rise to average at the end reporting period increases the possibility for average or above-average levels into the summer.

TABLE 1 - MONTHLY AVERAGE LAKE ERIE WATER LEVELS

(Based on a network of 4 water level gauges)

International Great Lakes Datum (1985)

	Metres			Feet		
Month	Recorded* 2010-11	Average 1918-2010**	Departure	Recorded* 2010-11	Average 1918-2010**	Departure
September	174.02	174.16	-0.14	570.93	571.39	-0.46
October	173.97	174.06	-0.09	570.77	571.06	-0.29
November	173.88	173.99	-0.11	570.47	570.83	-0.36
December	173.86	173.98	-0.12	570.41	570.80	-0.39
January	173.83	173.99	-0.16	570.31	570.83	-0.52
February	173.75	173.99	-0.24	570.05	570.83	-0.79

*Provisional **Period of record is 1918-2010

TABLE 2 - MONTHLY AVERAGE PRECIPITATION ON THE LAKE ERIE BASIN

	Centimetres			Inches			
Month	Recorded* 2010-11	Average 1900-2008+	Departure	Recorded* 2010-11	Average 1900-2008+	Departure	Departure (in percent)
September	7.87	8.13	-0.26	3.10	3.20	-0.10	-3
October	6.32	7.04	-0.72	2.49	2.77	-0.28	-10
November	9.27	7.28	1.99	3.65	2.87	0.78	27
December	4.72	6.78	-2.06	1.86	2.67	-0.81	-30
January	5.18	6.35	-1.17	2.04	2.50	-0.46	-18
February	10.21	5.31	4.90	4.02	2.09	1.93	92

*Provisional +Most recent period of record is 1900-2008

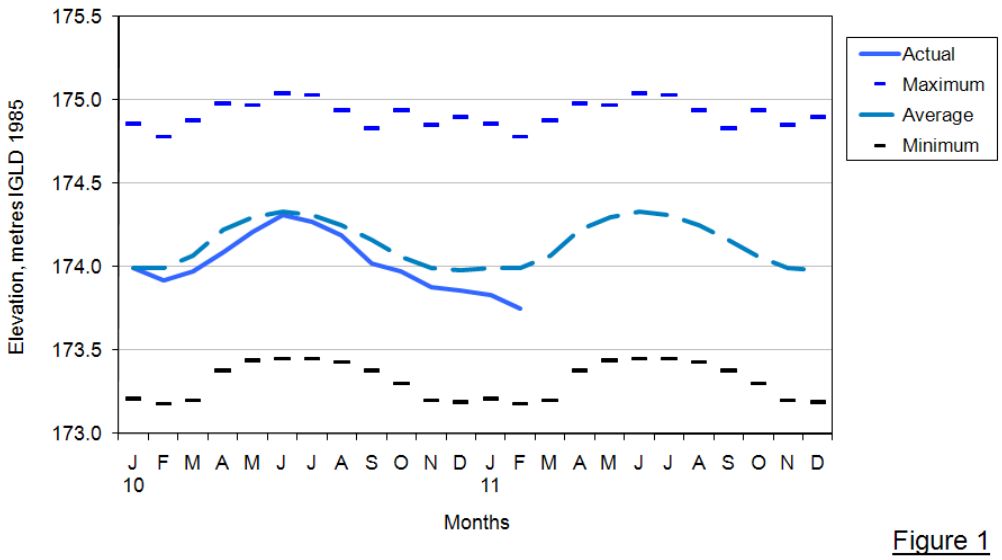


Figure 1

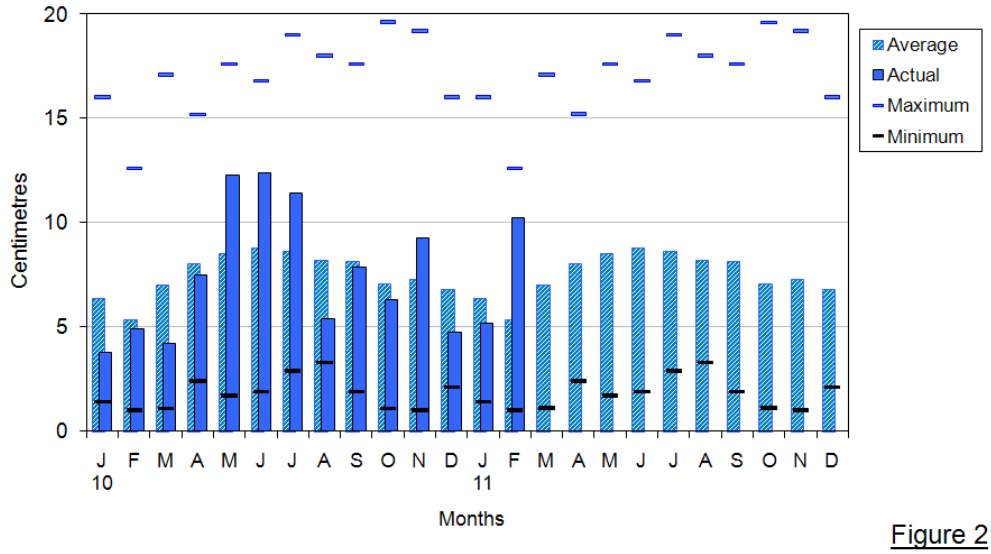


Figure 2

Monthly Net Basin Supplies
Lake Erie Basin

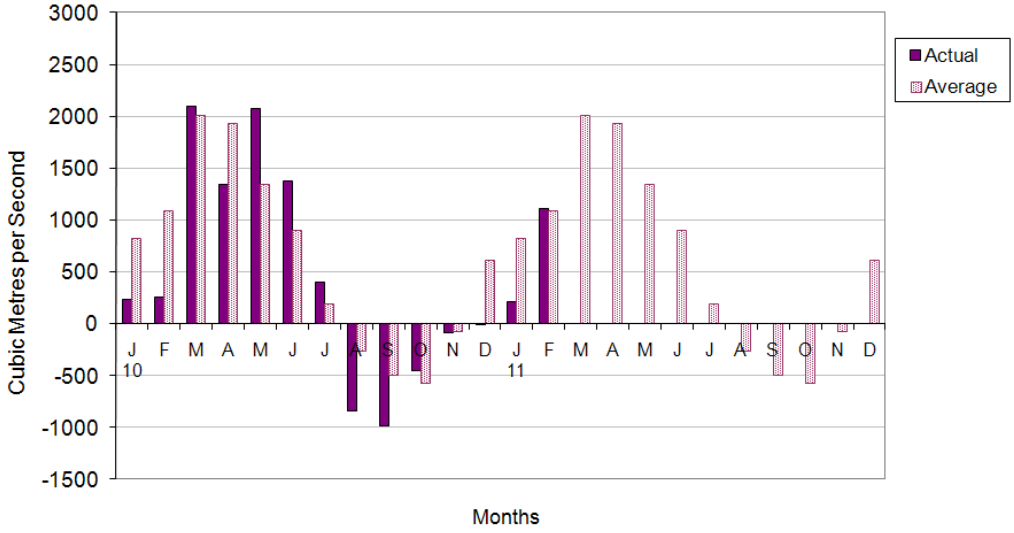


Figure 3

Niagara River Monthly Mean Flows
at Buffalo, New York

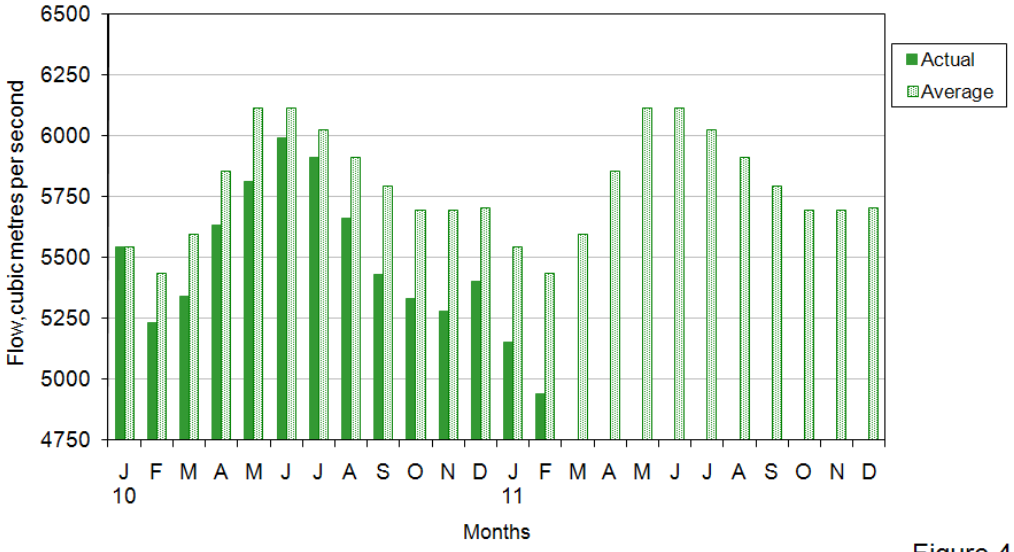


Figure 4

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 to ensure the maintenance of an operational long-term average CGIP level of 171.16 metres (561.55 feet) to ameliorate adverse 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.

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, 2011 was 0.30 metre-month (0.98 foot-months) above the long-term average elevation. The maximum permissible accumulated deviation is +/- 0.91 metre-month (3.00 foot-months).

Tolerances for regulation of the CGIP level were suspended for September 26 due to actions taken in response to a police emergency. Tolerances were also suspended for 12 days in January, 9 days in February and 1 day in March to assist in ice management and for two days in February due to abnormally low flows.

The locations of the water level gauges on the Niagara River are shown in Enclosure 1. Recorded daily Material Dock water levels covering the period September 2010 through February 2011 are shown in Enclosure 2.

Overhaul of Gate 10 (seals, cylinders, pistons and replacement of the roll plate) was completed in November 2010. However, the gate remains out of service while an oil line leak, that presents no environmental hazard, is repaired.

As a result of inspections done in 2008, replacement of oil lines on Gates 1-13 commenced in 2010 with work completed on Gate 2 from September 20 through November 24. This project will continue on the remaining twelve gates over the next 2½ years. Oil lines of the newer gates (Gates 14-18) do not need to be replaced.

4. FLOWS OVER NIAGARA FALLS

During the tourist season daylight hours, the required minimum Niagara Falls flow is 2832 cubic metres per second (m^3/s) (100,000 cubic feet per second (cfs)). At night and during the winter months, the required minimum Falls flow is 1416 m^3/s (50,000 cfs). The operation of the International Niagara Control Works, in conjunction with power diversion operations, ensures sufficient flow over the Falls to meet the requirements of the Niagara Treaty of 1950.

Falls flows were below Treaty requirements for a few hours during the mornings of October 30 and 31 to provide variation in flows during the discharge measurement program conducted to verify the Ashland Avenue rating. Falls flow met or exceeded minimum Treaty requirements at all other times during the reporting period. The recorded daily flow over Niagara Falls, covering the period September 2010 through February 2011, is shown in Enclosure 3.

5. 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 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 above.

The hydro power plants, OPG's Sir Adam Beck 1 and 2 in Canada and NYPA's Niagara Power Project in the United States, withdraw water from the CGIP above Niagara Falls and discharge it into the lower Niagara River at Queenston, Ontario and Lewiston, New York, respectively.

During the period September 2010 through February 2011, diversion for the Sir Adam Beck 1 and 2 plants averaged 1594 m^3/s (56, 290 cfs) and diversion to the Robert Moses Niagara Power Project averaged 1833 m^3/s (64,730 cfs).

The average flow from Lake Erie to the Welland Canal for the period September 2010 through February 2011 was 206 m^3/s (7,280 cfs) compared to 225 m^3/s (7,950 cfs) for the same period in 2010. Diversion from the canal to OPG's DeCew Generating Stations averaged 166 m^3/s (5,860 cfs) for the period September 2010 through February 2011.

Records of diversions for power generation covering the period September 2010 through February 2011 are shown in Enclosure 4.

The monthly average Niagara River flows at Queenston, Ontario, for the period September 2010 through February 2011 and departures from long-term average are shown in Table 3. Maximum and minimum monthly average flows, for the period 1900-2010, are shown in Table 4.

TABLE 3 - MONTHLY NIAGARA RIVER FLOWS AT QUEENSTON

Month	Cubic Metres per Second			Cubic Feet per Second		
	Recorded 2010-11	Average 1900-2009	Departure	Recorded 2010-11	Average 1900-2009	Departure
September	5428	5725	-297	191690	202180	-10490
October	5333	5643	-310	188330	199280	-10950
November	5300	5655	-355	187170	199700	-12530
December	5444	5692	-248	192250	201010	-8760
January	5129	5432	-303	181130	191830	-10700
February	4948	5538	-590	174740	195570	-20830
Average	5264	5614	-351	185880	198260	-12380

TABLE 4 - MONTHLY MAXIMUM AND MINIMUM NIAGARA RIVER FLOWS AT QUEENSTON

Month	Cubic Metres per Second				Cubic Feet per Second	
	Maximum	Year	Minimum	Year	Maximum	Minimum
September	6880	1986	4340	1934	242960	153260
October	7220	1986	4320	1934	254970	152560
November	7030	1986	4190	1934	248260	147970
December	7410	1985	4270	1964	261680	150790
January	7240	1987	3960	1964	255680	139850
February	6900	1987	3320	1936	243670	117240

During the period September 2010 through February 2011, the flow at Queenston averaged 5264 m^3/s (185,900 cfs). In 2009-10, flows for the same period averaged 5608 m^3/s (197,940 cfs) with the monthly averages ranging between 5287 m^3/s (186,710 cfs) and 5829 m^3/s (205,850 cfs).

6. GAUGING STATIONS

The Niagara River gauges used to monitor the CGIP levels and the flow over Niagara Falls are the Slater's Point, Material Dock, American Falls and Ashland Avenue gauges (see Enclosure 1). All gauges required for the operation of the International Niagara Control Works were in operation during the reporting period.

Both the U. S. National Oceanic and Atmospheric Administration (NOAA) and the Power Entities operate water level gauges at the Ashland Avenue location. Subject to continuing comparison checks of the water level data from both instruments by the International Niagara Committee (INC), the Power Entities' gauge is used for officially recording water levels used in determining the flows over Niagara Falls. However, the Power Entities' gauge at Ashland Avenue was not reporting level data from March 6 at 10:45 pm to March 9 at 10:45 pm. During this time data from the NOAA gauge was used to calculate flows over Niagara Falls. Comparison of water level readings from both gauges showed that they were within acceptable INC tolerances for the rest of the reporting period.

7. FLOW MEASUREMENTS IN THE NIAGARA RIVER AND WELLAND SHIP 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 flows in these channels for water management purposes. All measurements are obtained through joint efforts of the United States Army Corps of Engineers and Environment Canada. Measurement programs require boat, 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 Corps and Environment Canada continue their efforts to standardize measurement equipment and techniques.

Discharge measurements were conducted near the Cableway Section in October 2010. This series was made to verify the present Ashland Avenue gauge rating of the outflow from the Maid-of-the-Mist Pool below the Falls. The 2010 measurements fit the 2009 Ashland rating well with all measurement within 5% of the rating. No Board required discharge measurements are planned in 2011.

In the spring of 2007, Acoustic Doppler Current Profiler (ADCP) technology replaced conventional current meter measurements to verify the Ashland rating. This made the continued use of the cableway, located just upstream of the OPG and NYPA plants, redundant. The New York Power Authority, on behalf of the Power Entities, has undertaken to have the cableway removed. An on-site visit for potential contractors was held in February, bids were received in early March and the planned removal has been scheduled for May 15.

As a result of reviewing previous discharge measurements made near the International Railway Bridge, a revision of the 2001 Buffalo rating equation is underway and is expected to be completed by the fall of 2011. This rating is used by the Power Entities to determine preliminary estimates of Niagara River flows and ice and weed retardation. It is also used in Great Lake water supply routing models to estimate the flow in the Niagara River and to verify other Niagara River flow estimates.

Scheduled measurements were made in May 2010 to verify the rating used to determine flow through the Welland Canal Supply Weir. Due to the St. Lawrence Seaway Management Corporation's inability to provide water level data for that time period that is needed to complete the 2010 program, flow measurements will need to be rescheduled.

The next scheduled measurements are to be made near the International Railway Bridge and in the American Falls Channel in the spring of 2012.

8. NIAGARA TUNNEL PROJECT AND PLANT UPGRADES

OPG continues with construction of the Niagara Tunnel Project. The Tunnel Boring Machine (TBM) advanced into the intake grout tunnel on March 1. As of March 20, it had progressed 10089 metres (33,100 feet), 99% of the total length. Invert (bottom) concrete lining had been completed on 6875 metres (22,560 feet) while arch (top) concrete lining had progressed 1950 metres (6,400 feet). Concrete work at the tunnel intake was finished in January. When completed, the increased diversion capacity will mean that OPG's Sir Adam Beck plants can more fully utilize Canada's diversion entitlement for power production. Increased diversion will not affect the regulation of the CGIP which is governed by the International Niagara Board of Control's 1993 Directive.

OPG has also undertaken a unit runner replacement program for its 60 Hz Beck I units. Unit G9 upgrade was completed in December. Work on the next unit, G10 started in January 2011, and it is expected to be completed in January 2013.

The Beck I units were originally built with Johnson Valves at the bottom of the penstocks that could be activated to stop water from entering the units. These have been removed and their function replaced with headgates that can prevent water from entering the penstocks. As the units are upgraded, sleeves will be installed where the Johnson Valves were removed in order to improve flow through that portion of the penstock. A sleeve was not installed when G7 was recently upgraded, so that unit will be out of service from late February until mid-November to have this work done.

In addition, work continues on the replacement of ND1's (DeCew) penstocks and overhaul of its four units.

9. ICE CONDITIONS AND ICE BOOM OPERATION

In accordance with Condition (d) of the Commission's October 5, 1999 supplementary Order of Approval, installation of the Lake Erie-Niagara River Ice Boom's spans commenced on December 12. The Lake Erie water temperature as measured at the Buffalo Water Intake reached 4^{o} Celsius (39^{o} Fahrenheit) on December 8.

Installation of the ice boom's spans began on December 12 when 9 spans were placed starting from the Canadian side. Unfavourable weather conditions were experienced for the next two days. One span was installed on December 14, a further 7 spans, continuing on towards the US shore, were installed on December 15, with the final 5 spans placed on December 16.

On February 10, a helicopter flight was conducted to measure ice thickness on the eastern part of Lake Erie. Average thickness of six sites sampled was 21.5 centimetres (8.5 inches). Similar measurements taken in mid-February 2010 resulted in an average of 9 centimetres (3.5 inches).

Ice cover on Lake Erie peaked at the end of January with the lake being about 98% covered, almost double the seasonal average. However, by mid-February this had decreased to around 75% which was only slightly above average for that point in the season. It increased again to over 90% by the end of February and then began to decrease. By mid-March, the ice cover on Lake Erie was about 40% compared to the average of 30% for that point in the season.

On March 12, the second helicopter flight of the season was conducted. Of the six sampling locations, three were open water, two of the northern ones averaged 23 centimetres (9 inches) and the site near the south-east end of the lake had in excess of 90 centimetres (35 inches) of ice.

10. MEETING WITH THE PUBLIC

In accordance with the Commission's requirements, the Board will hold an annual meeting with the public in September 2011. The meeting will be in the Niagara Falls, Ontario area with the location and date to be determined. Information on items including current and projected Great Lakes levels, the operation of the Lake Erie-Niagara River Ice Boom, and OPG's Niagara Tunnel Project will be presented. The 2010 meeting was held in Niagara Falls, New York on September 15.

11. MEMBERSHIP OF THE BOARD

On February 4, Mr. Aaron Thompson became the Canadian Chair of the Board, succeeding Mr. Ralph Moulton. A position on both the Canadian Sections of the Board and its Working Committee remain vacant.

Mr. Gerald L. Cross of the Federal Energy Regulatory Commission replaced Mr. Peter Valeri on the U.S. Section of the Board's Working Committee. Mr. Valeri retired from federal service in December 2010.

12. ATTENDANCE AT BOARD MEETINGS

The Board met once during this reporting period. The meeting was held in Buffalo, New York on March 22. Colonel Drolet, alternate U.S. Board Chair, and Mr. Thompson were in attendance. Mr. Mahoney was unable to attend.

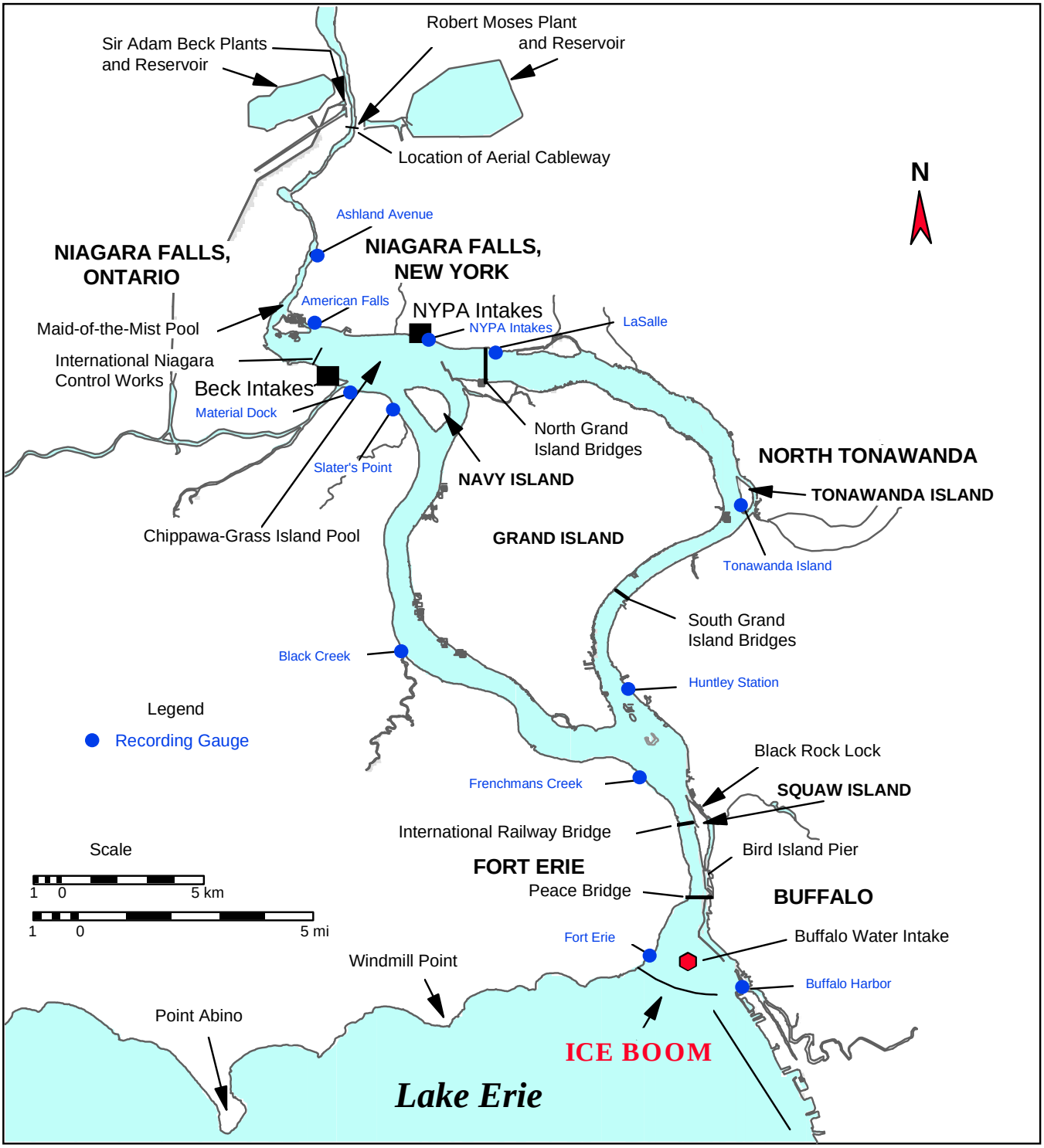
Respectfully Submitted,

MAJOR GENERAL JOHN W. PEABODY
Chair, United States Section

AARON THOMPSON
Chair, Canadian Section

DANIEL J. MAHONEY
Member, United States Section

VACANT
Member, Canadian Section

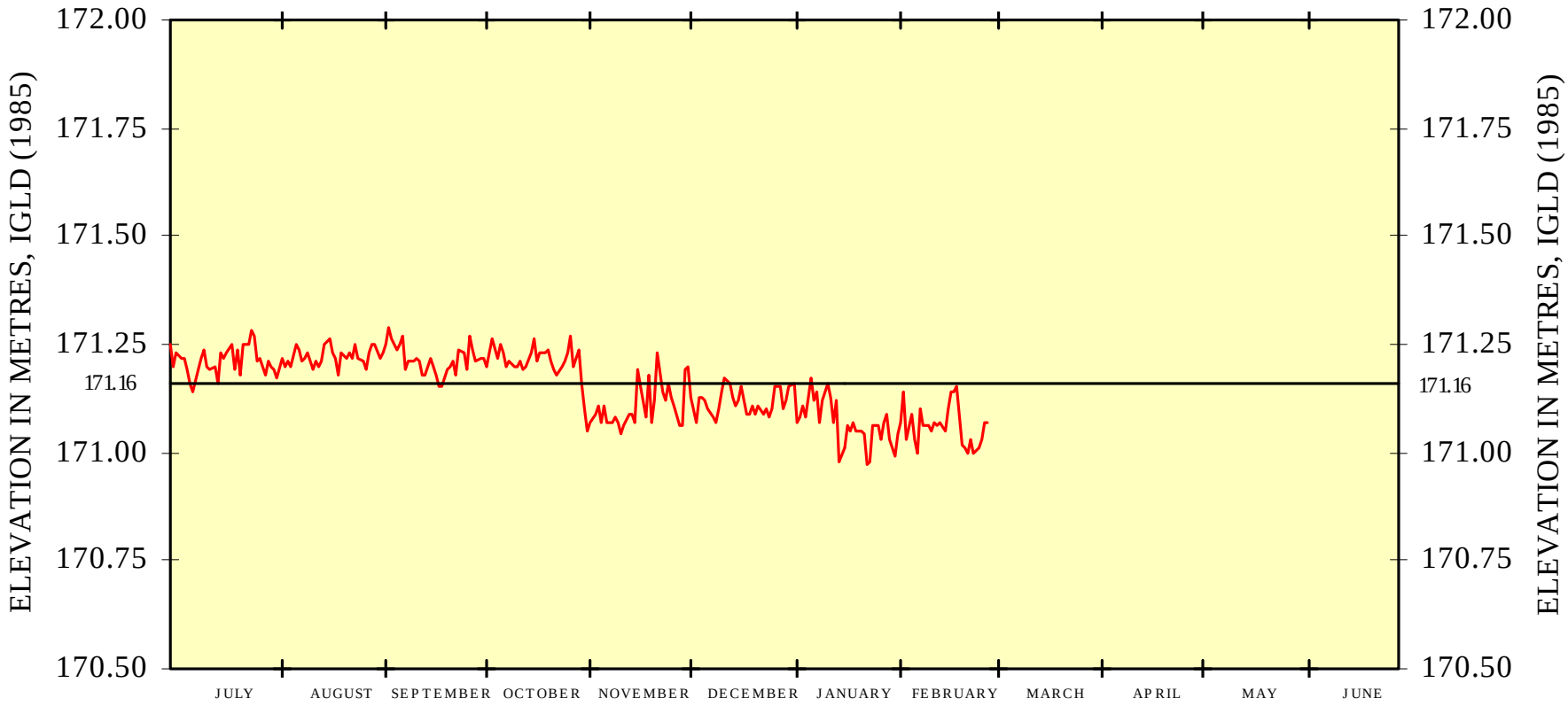

Sir Adam Beck Plants
and Reservoir
Robert Moses Plant
and Reservoir
Location of Aerial Cableway
N
Ashland Avenue
NIAGARA FALLS,
ONTARIO
NIAGARA FALLS,
NEW YORK
American Falls
NYPA Intakes
NYPA Intakes
LaSalle
Maid-of-the-Mist Pool
International Niagara
Control Works
Beck Intakes
Material Dock
North Grand
Island Bridges
NORTH TONAWANDA
TONAWANDA ISLAND
Slater's Point
NAVY ISLAND
Chippawa-Grass Island Pool
GRAND ISLAND
Tonawanda Island
South Grand
Island Bridges
Black Creek
Huntley Station
Legend
Recording Gauge
Black Rock Lock
Frenchmans Creek
SQUAW ISLAND
International Railway Bridge
Bird Island Pier
Scale
FORT ERIE
Peace Bridge
BUFFALO
1 0 5 km
1 0 5 mi
Fort Erie
Buffalo Water Intake
Windmill Point
Buffalo Harbor
Point Abino
ICE BOOM
Lake Erie

ENCLOSURE 1

NIAGARA RIVER DAILY MEAN LEVEL AT MATERIAL DOCK GAUGE

NOTE: LONG-TERM MEAN STAGE = 171.16 METRES, IGLD (1985)

JULY 2010 THROUGH FEBRUARY 2011

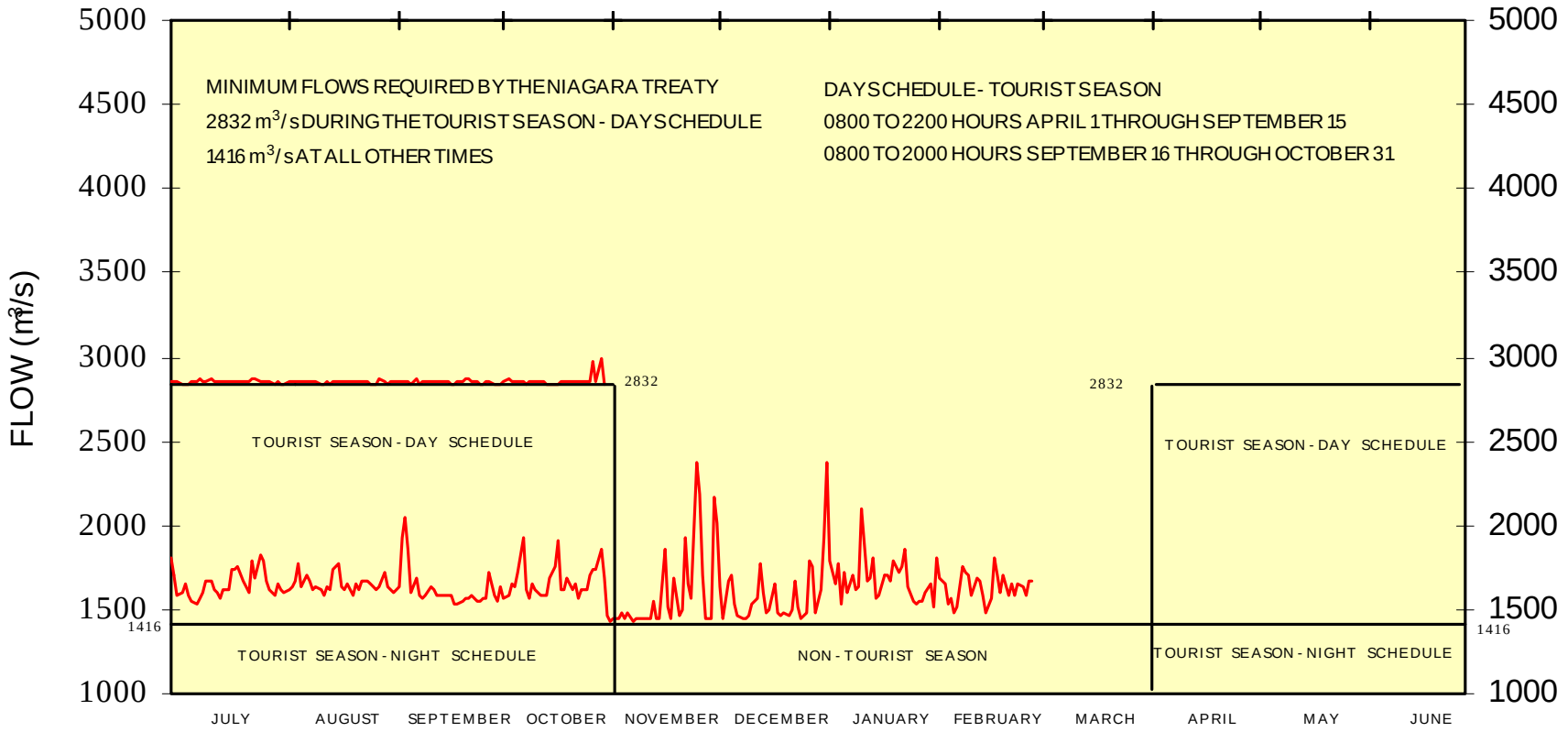


ENCLOSURE 2

DAILY FLOW OVER NIAGARA FALLS

FLOW AT ASHLAND AVENUE GAUGE IN CUBIC METRES PER SECOND (m^3/s)

JULY 2010 THROUGH FEBRUARY 2011

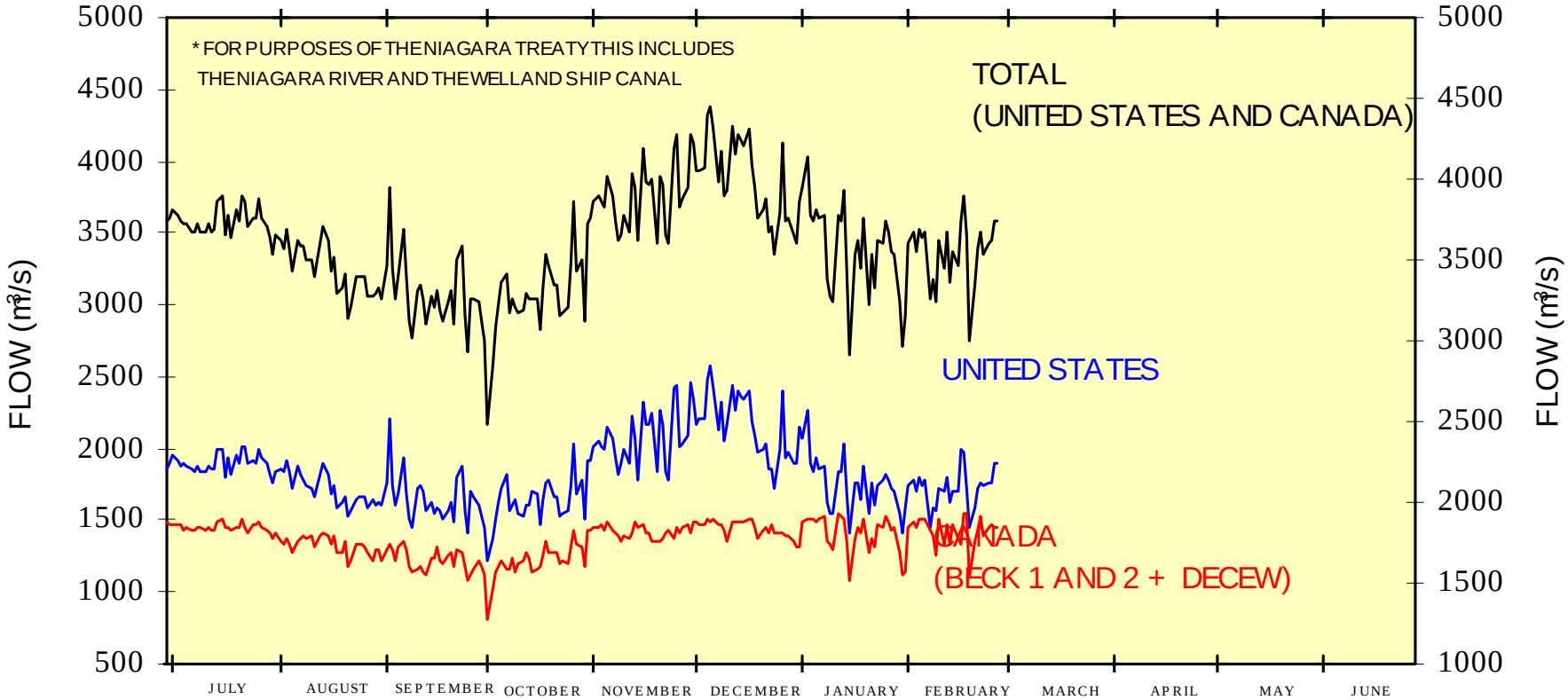


ENCLOSURE 3

DAILY DIVERSIONS OF NIAGARA RIVER WATER* FOR POWER PURPOSES

IN CUBIC METRES PER SECOND (m^3/s)

JULY 2010 THROUGH FEBRUARY 2011



ENCLOSURE 4