The Appleton Wetland;
Its Decline, Cause and Recommended Action

Addendum Number 1: Reach 18 Power Production
Executive Summary

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Executive Summary

The original report, *The Appleton Wetland; Its Decline, Cause and Recommended Action* dated August 11, 2014, included *Section 7.2.1 The Impact on Upstream Power Generation*. This section indicated that while the use of flashboards at the Enerdu Generator Station (GS) would be beneficial to Enerdu, it would probably reduce power output at the Appleton GS. The publication deadline for the original report precluded a rigorous quantitative analysis of this issue. This analysis has now been completed and shows that Enerdu flashboards result in a net power loss to the province.

The basic information required for estimation of hydro power production is the water flow through the turbine and the available head, the change in elevation between the headpond and the tailrace. A complete record of river flow from the Appleton Stream Gauge from 1918 to the present is available on the Environment Canada website (http://wateroffice.ec.gc.ca). That data includes mean river flow on a daily basis over the period 1918 to 2012. In addition, the Appleton Wetland Research Group (AWRG) recorded measurements of river levels versus river flow in 2013 and 2014 along with observations of other operational details. This data was sufficient to develop a mathematical model that yielded an accurate quantitative estimate of power production changes resulting from the use of flashboards.

To develop the model, the year was divided into 38 multi-day time blocks with the mean river flow for each block computed from the daily mean flow data. Turbine flow and head for each block were then derived from the other data and used to calculate the power output for each block. The model delivers the power output for each block in the year for both the Enerdu GS and the Appleton GS under conditions of no flashboards at Enerdu, and with flashboards installed. The change in block output with flashboards installed was then calculated for each GS, and for the net total output of both plants. The annual total power production change for a year with “average” flow is the sum of all block output changes, and that is also tabulated by the model.

As expected, block by block throughout the year, Enerdu has an increase of power output when flashboards are used. On the other hand, for each corresponding time block Appleton has a larger loss of power, resulting in a loss of net total power for the two generating stations. The annual total power production change shows Enerdu gains 160 MWHr (Megawatt-Hours), Appleton has a loss of 235 MWHr, and the net total shows a loss of 75 MWHr.

The original report, *The Appleton Wetland; Its Decline, Cause and Recommended Action,* conclusively showed that the decline of the maples in the Appleton Wetland was a direct result of using the Enerdu flashboards, and recommended that the Mississippi River Water Management Plan (MRWMP) be amended to restrict such use.

The results from the Power Production Model demonstrate that the optimum power production case, on a system basis for Reach 18, is for no flashboards or other weir height increase at Enerdu. This is also the requirement for recovery of the Appleton Wetland maples. The AWRG strongly recommends that the MRWMP be amended immediately to eliminate the flashboards. With such an amendment, traditional water levels will be restored and the process of wetland recovery can begin in the summer of 2015, along with maximum net total power production for the province of Ontario.