GREAT LAKES WATER LEVEL REGULATIONS

By: Beth Engel
I. INTRODUCTION

The Great Lakes Basin, storing 5,439 m$^3$ of water, is comprised of the lakes and connecting channels and tributaries bordering eight American states and two Canadian provinces.\(^1\) The Great Lakes are a valuable resource to the forty million people living in the basin, to those conducting business on and around the waters, and to the diverse plants and animals in the basin. Together, these various groups using and relying on the Great Lakes have competing interests in and uses for the Great Lakes. As a result, in Lake Ontario, new proposed water level regulations have been halted after the regulatory authority could not appease the conflicting interests. Similarly, after projects in the Great Lakes Basin reduced water levels in Lake Michigan-Huron, an examination of various interests impacted by restoration of the Lake Michigan-Huron water levels was necessary due to opposition of both the current low lake levels and proposed raised lake levels.

II. REGULATION OF THE GREAT LAKES

The 1909 Boundary Waters Treaty established the International Joint Commission (IJC) to prevent and resolve disputes between the United States and Canada regarding the quantity and quality of water along the boundary between the two countries.\(^2\) The IJC determines whether to approve projects affecting the boundary waters and also has the power to regulate these projects. Under this authority, the IJC can conduct studies, at the request of the United States and Canada, regarding particular issues concerning the Great Lakes. Often, the IJC commissions a board of experts to oversee and conduct each study. Based on the results of a study, the IJC provides

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recommendations to the United States and Canada. Together, the two governments then decide whether to implement the recommendations.³

When the IJC approves projects in the Great Lakes or uses for the water in the Great Lakes, it must protect competing interests simultaneously. The Boundary Waters Treaty of 1909 sets forth the following priority of interests the IJC should consider when making decisions about the use of the boundary waters: (1) uses for domestic and sanitary purposes; (2) uses for navigation, including service of canals for the purposes of navigation; and (3) uses for power and for irrigation purposes. Notably, environmental and recreational interests are absent from the list. This broad range of interests often creates conflicts regarding the proper uses and regulations for the Great Lakes, thus making it difficult for the IJC to approve projects and regulations.

At the forefront of these disagreements lies the dispute over Great Lakes water level regulation. Because the Great Lakes are interconnected, projects in any part of the Great Lakes Basin influence all of the other areas in the basin. For this reason, although the IJC only regulates water levels throughout the Great Lakes at the St. Marys River and St. Lawrence River, these regulations impact all of the lake levels and all of the different interest groups.

III. WATER LEVEL FLUCTUATIONS IN THE GREAT LAKES

A. The Impact of Water Level Fluctuations Throughout the Great Lakes

The Great Lakes water levels naturally fluctuate daily, seasonally, yearly and in long-term cycles due to winds, precipitation, runoff, temperature and water use. The water levels experience extreme high and low levels approximately every 150-160 years and less extreme

highs and lows every 30-33 years. These water level changes influence the biological communities of the Great Lakes, as well those who use or rely on the Great Lakes.

Changes in water levels affect plant and animal communities by disturbing plant zones, altering the area of aquatic beds, and transforming the composition of plant and animal assemblages. These fluctuations significantly impact wetland structure and function. In the Great Lakes coastal wetlands, wet meadows are the most species-rich habitat. Historically, water level variation has protected the wide range of wildlife. Low water levels allow vegetation to develop from a seed bank on bare soil, while subsequent flooding influences which species flourish. As water levels are stabilized by regulation, this constraint diminishes, allowing invasive species to expand and alter habitat dynamics by reducing species biodiversity. This threatens the ecological integrity of regional wetlands. (Frieswyk & Zedler 2007.) While these water level variations are beneficial to the wetlands, water level fluctuations can also negatively affect the sediment of the lakes. The sediment resuspension caused by water level variations can increase the murkiness of the lake water, the planktonic productivity and the damage to ecological habitats at the lowest levels of the lake. (Dusini et al. 2009.)

Further, water level fluctuations can adversely impact those who live on or use the Great Lakes. In the 1980s, high water levels caused coastal erosion and damaged structures along the lakes. Low water levels in the late 1990s isolated inlets, bays and marinas, which blocked access to ports used both commercially and recreationally. Recreational boaters cannot safely boat when water levels are too low or too high and, as a result, boating and tourism revenue is decreased by either extreme. With these varying interests in conflict, the IJC is working to create new regulations for the Great Lakes water levels at different locations throughout the basin.
B. Regulation of Lake Ontario Water Level Fluctuations

Lake Ontario water levels have been regulated since 1959 when the St. Lawrence Seaway opened. The water levels are primarily controlled by the Moses-Saunders hydroelectric dam between Cornwall, Ontario and Massena, New York. The IJC approved the construction of the dam and now regulates water flow through it. The current water flow regulations reduce high lake levels typically experienced during high water-supply periods and raise low lake levels experienced during low water-supply periods. As a result, the lake level range has been reduced from 1.5 meters before the regulation to 0.7 meters. (Wilcox et al. 2008.)

The IJC is working to change current water level regulations in Lake Ontario, but its efforts have been thwarted by conflicting interest groups. In December of 2000, the IJC established a Study Board to launch studies to evaluate new plans for regulating the water levels of the Lake Ontario-St. Lawrence River system. The Study Board conducted a five year study that was released in 2006 and contained various regulation options. The IJC, based on the Study Board’s findings, released a proposed new regulation plan, Plan 2007, for public comment. Due to divergent opinions by various interest groups and protests by those protecting environmental interests, the IJC concluded Plan 2007 could not be implemented.

In light of the failed proposal, the IJC determined that lake level regulation should be based on a revised set of goals, objectives, and criteria. Although it recognized all interests need to be respected, the IJC determined the water level regulation should move towards more natural water flows to benefit the environment. Even though the Boundary Waters Treaty of 1909 does not list environmental interests as a proper consideration for the IJC to recognize when regulating the Great Lakes, the important role the environment plays in the Great Lakes system mandates its consideration.
When examining the regulatory impact on the environment, special focus is placed on wetlands because of the heightened sensitivity wetlands have to even minor changes in water levels. Studies have shown that lake level regulation in Lake Ontario led to a decrease in meadow marsh and a large increase in emergent wetland dominated by cattails, due to favorable conditions created by water level stabilization. (Wilcox et al. 2008.) Further, scientists believe muskrat populations in Lake Ontario/upper St. Lawrence River wetlands declined significantly following water level regulation. The low lake levels limit the muskrats’ ability to build houses and the houses that are built are often isolated from water during the winter due to the reduction in water levels in anticipation of spring runoff. As a consequence of the reduced number of muskrats, consumption of cattails diminishes, allowing cattails to invade other habitats. Spring-spawning fish are also disturbed by current lake level regulation, as the fish cannot access wetlands due to the low levels of water and the invasion of meadow marsh habitats by cattails. (Wilcox & Xie 2008.)

Therefore, the IJC formed a Working Group in 2009 to advise the IJC on water level control in the Lake Ontario-St. Lawrence system and on how to better define and adequately protect all interests impacted by the Moses-Saunders Dam. The Working Group meets approximately four times a year and has created groups of experts to study a variety of scientific and technical issues implicated by water level regulation. The Working Group is developing a new approach for regulation of water levels in the Lake Ontario-St. Lawrence River system that encourages the restoration of wetlands and habitats for vital species by allowing more natural flows throughout the system while still protecting other interests. All proposed regulatory plans will consider the interests of hydropower, shipping, municipal-industrial water supply, recreational boaters, riparian landowners, and the environment. The Working Group last met on
April 27 and 28 of 2011 to discuss technical issues of an unpublished draft regulation plan outlining the new approach for improved management of water levels and flows in the Lake Ontario-St. Lawrence River system.

C. Regulation of Lake Huron Water Level Fluctuations

Lake Huron and Lake Michigan are hydrologically inseparable and have the same surface water elevation, as they are joined by the Straits of Mackinac. The outflow of Lake Michigan-Huron through the St. Clair River, Lake St. Clair and the Detroit River is not regulated but depends, in part, on the level of Lake Michigan-Huron. Further, the level of Lake Michigan-Huron affects the regulation of the Lake Superior outflow. This resulting water system provides very little opportunity for regulation of upper Great Lakes water levels beyond the regulation of Lake Superior at the St. Marys River.

However, because of human activities in the upper Great Lakes, a new form of regulation may be needed due to dropping water levels in Lake Michigan-Huron. Beginning in the 1850s and continuing through 1962, dredging projects occurred in the St. Clair River and Lake St. Clair to enhance navigation and remove sand and gravel. Dredging of the St. Clair River lowered Lake Michigan-Huron’s level due to increases in the St. Clair River’s conveyance (water-carrying capacity) and nothing was done to maintain the pre-dredging water level conditions. In 1998, the water levels of the upper Great Lakes began to decline after 30 years of above-average water level conditions. Commercial shippers, property owners and others were extremely concerned with the low lake levels, particularly in the Georgian Bay where a rocky archipelago of thousands of islands is inaccessible by boat when water levels are extremely low. In 2005,

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Georgian Bay Forever, a community organization, commissioned a study to investigate the low water levels. The study concluded that the ongoing and significant drop in the difference between Lake Michigan-Huron and Lake Erie water levels was due to river bed erosion, possibly caused by human activities such as dredging of the St. Clair River. In 2007, the IJC directed the International Upper Great Lakes Study (IUGLS) to examine the impacts of the St. Clair River changes occurring after the 1962 dredging on the levels of Lake Michigan-Huron.

This study, released in 2009, found that the water level difference between Lake Michigan-Huron and Lake Erie declined by approximately nine inches between 1963 (the time of the last major navigational channel dredging in the St. Clair River) and 2006. The decline was influenced by a change in the conveyance of the St. Clair River, uneven shifts in the earth’s crust since the last period of continental glaciations ended, and alterations in climatic patterns. It further concluded that since 2000 there has been no significant erosion of the channel along the length of the St. Clair River bed. Based on these findings, the study did not recommend any remedial measures to be undertaken in the St. Clair River. However, in 2010, the IJC requested an exploratory-level analysis of the impacts of and requirements for restoring Lake Michigan-Huron to various water levels.

On May 26, 2011, the IUGLS released its report analyzing options for restoring Lake Michigan-Huron water levels. The report indicates that restoring Lake Michigan-Huron water levels by reducing the conveyance capacity of the St. Clair River would provide a range of benefits and negative consequences to various interest groups. In general, restoring water levels would alter navigation carrying capacity for the benefit of navigation interests, provide increased

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5 Id.

access to marina slips and boat launch access points, and would not adversely impact municipal and industrial water supply. At the same time, it would create net hydropower losses by decreasing power production. Erosion, flooding, shoreline damage and coastal shore protection costs would all increase if water levels are restored. Any proposed restoration structures are predicted to have positive ecological effects in the Georgian Bay region, but uniformly negative ecological effects in the Lake Huron to Lake Erie corridor, which is the habitat of five endangered species.

The report also outlines the affects of Glacial Isostatic Adjustment (GIA), noting that the Great Lakes are shifting and uplifting at rates that diminish the beneficial effects of any restoration actions. Any benefits the Georgian Bay region would gain from restored water levels would be brief and limited because, as the appropriate structures are constructed and implemented to raise water levels, the Georgian Bay region would continue to uplift due to GIA impacts. Thus, the restoration would ultimately only minimally alter water levels and subsequent GIA impacts would continue to lower water levels in the region. For these same reasons, flooding would increase in frequency and magnitude in other regions of the lakes where GIA impacts cause shorelines to subside and lake levels to rise.

Lastly, the report details the difficulty in assessing climate influence on water levels. While some fluctuation in water level is expected to occur as a result of climate change, different prediction models produce conflicting results regarding whether lake levels will rise or decline. If climate change causes a rise in water levels, this will compound the negative effects of restoration, leading to increased flooding and erosion. If climate change instead decreases water levels in the Great Lakes, restoration efforts may help to offset the water level decline.
IV. FUTURE REGULATION

The IJC’s attempts to establish new regulations controlling Lake Ontario’s water levels and to restore water levels in Lake Michigan-Huron have been lengthy and unsuccessful due to many factors. First, because the Boundary Waters Treaty was drafted over 100 years ago, it does not anticipate important interests and concerns relevant to current regulations, yet it still dictates the IJC’s authority. Second, in the past, regulation plans have been considered, analyzed and implemented based on historic water levels and past regulation practices. (Clites & Quinn 2003.) However, reliance on this information may adversely impact regulatory decisions. Some researchers suggest lake level variability and frequency of extreme levels has been greatly decreased over the last century and therefore these influences were not properly accounted for when the current regulations were developed. For example, the water level data used to develop Lake Ontario regulation plans is quite different from the water levels in Lake Ontario since the regulations were implemented. (Quinn & Sellinger 2006.)

Lastly, climate change generally has been left out of the regulation equation. The National Assessment of Climate Change predicts global warming on the Great Lakes will cause higher lake evaporation and a change in precipitation. While it is unclear whether this will cause an increase or decrease in lake levels, it will alter lake levels. Research supports this. A shift has occurred in the timing and range of seasonal lake-level cycles, with the minimum lake levels appearing two months later over the past one hundred years. Climatic factors, such as ice retardation in the St. Clair River and variation in seasonal water supplies due to regional warming, are believed to be driving this shift. The shift has serious consequences on lake level regulation and future planning for water level control. (Argyilan & Forman 2003.)

In order to implement effective water level regulations in the Great Lakes in a manner that respects environmental, social and economic interests, the IJC needs to undertake a
comprehensive analysis of all factors influencing water levels. The IJC cannot draft appropriate regulations or properly evaluate proposals for projects in the Great Lakes with a distorted focus or incomplete data. Its narrow focus and limited considerations (dictated by the Boundary Waters Treaty) supporting the various projects and regulations in the Great Lakes over the past century created the current need to regulate water levels in Lake Ontario and Lake Michigan-Huron. For this reason, it is crucial that future decisions by the IJC regarding the water levels of Lake Ontario and Lake Michigan-Huron properly consider the impact such changes will have on the entire Great Lakes basin and all interest groups.

The IJC’s decision to consider the environment, among other considerations, when drafting regulations regarding Lake Ontario water levels is the first step in doing this. However, these environmental considerations cannot be appropriately factored into a decision by the IJC without accurate predictions of both future water levels and the influence climate change will have on these water levels. The IJC’s creation of the Working Group to develop a new approach for regulating Lake Ontario water levels and its request for the IUGLS report on Lake Michigan-Huron water level restoration appear to be a method for gathering more accurate data from which the IJC can make more informed decisions. While this updated analysis will help the IJC to understand how the various interests in the Great Lakes are affected, the effectiveness of any future regulations or projects is dependent on the quality of the information the IJC uses to makes its decision. A continued focus on developing ways to accurately estimate future water levels and other important data will help the IJC to solve the issue of water level fluctuations in the Great Lakes and prevent more harm in the future.
Bibliography of Scientific Studies Referenced


