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GEORGIAN BAY FOREVER

Protecting your water.

WATER LEVELS, WATER QUALITY AND ECOSYSTEMS

CREATING CLIMATE RESILIENCE

PROVIDING STRUCTURAL SOLUTIONS FOR ADAPTIVE MANAGEMENT IN THE GREAT LAKES

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Also Inside:

IMPORTANT AND ONGOING PROJECTS

Preserving and protecting Georgian Bay is at the heart of what Georgian Bay Forever does to maintain the health, safety and security of its waters for generations to come. A quick snapshot of our projects follows. Please give today at www.gbf.org — your generous support enables this work.

ECOSYSTEMS

Fighting invasive species

GBF mobilizes communities across the Bay to eliminate **Phragmites, an invasive reed** that threatens its coastal wetlands. Review progress on this project at:

http://gbf.org/invasive-phragmites/

Identifying hot spots in need of protection

GBF is working with the University of Guelph (UG) to build an aquatic biodiversity library using DNA barcoding. This allows us to monitor the health of ecosystem diversity, under threat from human impacts, and pinpoint areas in need of protection. More information at:

http://gbf.org/dna-barcoding/

Researching cage aquaculture impacts to ecosystems

Expansion of net-pen (or cage), aquaculture operations in the Great Lakes is advancing. Ontario is unique in Great Lakes jurisdictions allowing net-pen aquaculture in public water. GBF is compiling freshwater research and examining data with the UG to determine if high density net-pen aquaculture poses a threat to the safety of the ecosystem. More information at:

http://gbf.org/net-pen-aquaculture/

Evaluating habitat for declining fish species to help prioritize sites for remedial action

With Walleye, Lake Sturgeon and Sucker species on the decline in areas of Eastern Georgian Bay, GBF is partnering with the Eastern Georgian Bay Stewardship Council on their 32-month project to survey eight tributaries within the Parry Sound District. More information at:

http://gbf.org/2016/03/21/fish-tributaries-help/

WATER QUALITY

Standardizing a water quality protocol

GBF continues its 2-year partnership with the Georgian Bay Biosphere Reserve and other key partners to harmonize water testing protocols. Currently, there are 15 different water-testing protocols across the Bay. Tracking water quality data more consistently will better inform water quality research and government decision making and allow for scientific comparisons between regions. More information at:

http://gbf.org/standard-water-quality/

WATER LEVELS

Creating climate resilience. Providing structural solutions for adaptive management in the Great Lakes

GBF retained the services of AECOM, a highly respected global engineering firm, to assess and recommend contemporary climate resilient structural options to mitigate plausible future extreme water levels of Lake Michigan-Huron and Georgian Bay. Read more in this issue, or visit:

http://gbf.org/water-levels/creating-climate-resilience/

EDUCATION

Driving awareness of the threats to Georgian Bay's ecosystems

Educating the public and governments regarding environmental protection, conservation, the safety and preservation of the water and the natural features of Georgian Bay enhances public appreciation for the environment. For recent topics such as *Stopping Asian carp, Chemicals of mutual concern* and more, visit:

gbf.org. Join our email list and follow us on Facebook, Twitter, and Instagram.

GEORGIAN BAY FOREVER

Georgian Bay Forever is a community response to the growing need for major research and education to sustain the Georgian Bay aquatic ecosystem and the quality of life its communities and visitors enjoy.

We help monitor the Bay's well being, throughout the seasons, year after year.

We fund the research needed to protect the environmental health of Georgian Bay and the surrounding bodies of water. Using our research findings, we inform and educate the general public and governments about threats to environmental health and propose possible solutions.

Through workshops and seminars we are educating the Georgian Bay community. By teaming up with reputable institutions, we enhance the credibility of our research and we strengthen our ability to protect what's at stake.

Georgian Bay Forever, formerly the GBA Foundation, is a registered Canadian charity (#89531 1066 RR0001). We work with the Great Lakes Basin Conservancy in the United States, as well as other stakeholder groups all around the Great Lakes.

Deeply rooted and broadly drawn, Georgian Bay Forever is steered by lifelong devotees of the Bay. We are committed advocates, educators, environmentalists, realists, idealists, and of course, residents.

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Canadian citizens may send their donations to the Caledon address above.

U.S. citizens wishing to make a donation to support our work can do so by giving to:
Great Lakes Basin Conservancy
PO Box 504, Gates Mills, OH
44040-0504, USA

This newsletter is just a snapshot of our work. For the most up-to-date information on our projects, longer versions of newsletter articles and breaking news about Georgian Bay, please become a regular visitor to our website and Facebook page.
GBF.ORG

Design by Key Gordon (keygordon.com)
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LOOKING TO THE FUTURE

By Peter Singer

GBF has been out there Phragbusting with you in your communities this summer. Protecting Georgian Bay from invasive species like Phragmites and working on water quality are ongoing priorities.

However, our most frequently visited website page is "Current Water Levels." Based on our recent survey on the "Top Ten Threats to Georgian Bay," worry remains over future water levels and the scientific community backs up your unease. It is normal for water to rise and fall—water levels have historically fluctuated in Lake Michigan-Huron by about six feet. Fluctuations are important for maintaining a healthy ecosystem but research shows that more rapid changes in the range and speed of fluctuation are occurring and that extremes are increasingly possible from climate change.

As the earth continues to get warmer—July just set another record—precipitation is changing with a tendency to more intense rainfalls intermixed with drought-like periods. Evaporation and warmer water are having increasing impacts as more than 200 scientists, engineers, planners and technical experts in the IJC's International Upper Great Lakes Study have concluded.

Thanks to your support progress is being made to improve resilience to these climate driven extremes. GBF has been working for 20 years on establishing cause, measuring costs and finding solutions around threats to our water levels. We have listened to scientists and worked diligently with key stakeholders including the IJC, the Council of the Great Lakes Region, residents both for and against structural intervention, the shipping industry and many others that drive the $5.8-trillion Great Lakes regional economy. GBF continues to inject balanced, fact-based engineering solutions into the many official processes.

GBF commissioned renowned international engineering firm AECOM to develop a suite of possible climate resilient solutions to finally solve this problem and allow the IJC to fulfill their obligations to steward the Great Lakes for future generations.

THANK-YOU AGAIN FOR YOUR CONTINUED SUPPORT.

EXTREME HIGH AND LOW WATER

The waters of Lake Michigan-Huron, which are connected to Georgian Bay, fluctuate for a variety of reasons within about 1.83 m (six feet). However, in the last few decades, climate change has played a role and as we look to the future, climate change will continue to do so driving fluctuations to new extremes.

While this summer water levels were about average, the Bay has just experienced its longest stretch of low water levels, lasting from 1999 to January 2013. During this period, levels measured below the historic low previously set in 1964 and were 70 cm below the long-term seasonal average for extreme low levels. Extreme high water levels from flashy storms that are more common due to climate change, are also a possibility.

WHAT ARE THE RISKS?

Prolonged Low Water Impacts	High Water Extreme Impacts
Strand wetlands and decrease quality of aquatic fish habitat	Risk of flooding which can damage infrastructure used commercially, and by residents and tourists
Impact recreational, commercial and residential use, create access problems to the water and homes	Beaches, residential properties and coasts can be subject to erosion with damage to coastal structures and waterfront homes
Degrade and increase infrastructure costs	Farmland, wells and municipal and industrial water systems at risk
Exacerbate water quality degradation	

*Read the "Low Water Blues" summary from the GBF, Council of the Great Lakes Region, and Mowat Centre study at http://gbf.org/wp-content/uploads/2015/10/low-water-blues-exec-sum.pdf. This study was also partially funded by the Ontario Government.

WHAT CAN BE LEARNED FROM STRUCTURAL INTERVENTION IN THE OTHER GREAT LAKES?

By Heather Sargeant

Lake Ontario and Superior have structures and regimes to manage water level variability; Georgian Bay as part of Lake Michigan-Huron does not. More extreme variability in water levels due to climate change is a costly problem that future generations are facing. Here are some important learnings on water variability, the benefits of water levels management and the pitfalls that need to be avoided.

GREAT LAKES WATER LEVEL VARIABILITY IS NATURAL AND GOOD

Fluctuations are an important part of helping maintain wetlands biodiversity and ecological services. Ups and downs are therefore critical to the health of lake ecosystems, including aiding in water quality so important for drinking.

While the Lakes' water levels fluctuate in all kinds of different time spans, GBF looks **at seasonal (one-year) fluctuations** of Great Lakes water levels and **water level variability over long periods** of time spanning decades.

Seasonal or annual behaviour

While peak times vary by Lake, typically higher water levels start during the spring and early summer, and lower water levels happen during the remainder of the year. Based on the monthly average water levels, the magnitudes of unregulated seasonal fluctuations are relatively small, averaging about 1.3 ft. (0.40 m) on Lakes Superior and Michigan-Huron, about 1.6 ft. (0.49 m) on Lake Erie, and about 2.0 ft. (0.61 m) on Lake Ontario (Great Lakes Commission, 2003).[1]

Variability, a historical perspective

These Great Lakes examples provide a general sense of the greater scale of lake level change over time.

- **Lake Michigan-Huron**
  Michigan-Huron has as a wide range of water-level fluctuations in recorded history, with a difference of 6.3 ft. (1.93 m). A maximum of 582.35 ft. or 177.50 m (GLWLD) in October 1986 and a minimum of 576.02 ft or 175.57 m in January 2013.[2]
- **Lake Ontario**
  Prior to regulation in 1956, levels ranged from a maximum of 248.56 ft. or 75.76 m in June 1952 to a minimum of 241.93 ft. or 73.74 m (GLWLD) in December 1934, a total of 6.6 ft. (2.02 m).[3]
- **Lake Superior**
  Pre-regulation data spans only 55 years, and the 3.6 ft (1.10 m) range from 603.2 ft. or 183.97 m (August 1876) to 599.6 ft. or 182.90 m (February 1866).[4]

NEW EXTREME VARIABILITY FROM CLIMATE CHANGE CAN BE REDUCED BY STRUCTURAL INTERVENTION

A short explanation of the interventions

Lake Superior water level regulation began in 1921 accounting for the needs of navigation, hydropower and landowners. Outflows are set with many interests considered upstream and downstream. Control structures such as gates, locks and power canals cross the St. Mary's rapids which, is where Lake Superior outflows to Lake Michigan-Huron (and thereby Georgian Bay).[5]

Lake Ontario was subjected to various projects undertaken between 1825 and 1905 to facilitate navigation, but current water regulation began in 1956 mostly as a response to US shoreline property owners concerned about flooding they experienced in the early '50s, with hydropower and navigation being highly considered. Built between 1954 and 1958, the principal control structure is the Moses-Saunders Dam that crosses the St. Lawrence River between Cornwall, Ontario and Massena, New York.[6]

High and low extremes are costly for a variety of stakeholders on the Great Lakes including property owners, shipping, recreational boating and fishing, hydroelectric power generators and users and more. For instance, an IJC Study Board found that regulation "reduced the damages due to fluctuating water levels on Lake Ontario shoreline properties by about 60%".[8]

Since Lake Michigan-Huron does not have structures in place that can help mitigate the extreme highs and extreme lows, stakeholders on these Lakes are vulnerable to damages and high costs that result from extreme variability in water levels. GBF helped fund the Council of Great Lakes Region "Low Water Blues" report that details plausible future costs over the next 35 years at about $18.82 billion USD if nothing is done.[9]

The good, the bad, and the ugly of reduced fluctuations in Lakes Ontario and Superior

- **Good**
  Some extremes are moderated. For example, "unregulated Lakes Michigan-Huron and Erie had extremely high water-level peaks in 1929, 1952, 1973, 1986, and 1997, as well as extreme lows bottoming out in 1926, 1934, 1964, 2003 (with new records set in 2012 and 2013). Some of those extreme levels, especially the lows, were muted in Lakes Superior and Ontario after regulation began."[7]
- **Bad**
  Environmental concerns were not part of the initial criteria when regulation and structures were put into place in Lake Superior and Lake Ontario so many decades ago.
  Additionally, structures were built on the historical record of hydrology prior to 1954 and not on changing hydrology brought about by climate change.
- **Ugly**
  This has been particularly devastating to Lake Ontario, where the variability has been so limited that it has led to the degradation of more than 26 thousand hectares of wetlands.
  Despite a general desire to address and fix the issues in the last 20 years, and after several proposals and millions of dollars spent, the economic trade-off to return to a regime with more natural variation, has so far met with too much opposition.[10]

Continue reading →

AVOIDING MISTAKES WHILE PROTECTING THE FUTURE

✓ **Variability maintained**

AECOM's proposals for **Lake Michigan-Huron** (and by extension Georgian Bay) include retaining variability within historical norms.

✓ **Taking the edges off**

The huge surface area of Lake Michigan-Huron makes it extra susceptible to climate change impacts like increased evaporation and flashier storm systems. The technology being proposed would mitigate future extreme highs and lows that result from climate change and that without intervention would be extremely costly. The proposals have considered up-to-date technology that was not available in other Great Lakes examinations of structural interventions.

✓ **Consultation–bringing stakeholders together**

AECOM and GBF continue to garner widespread support by giving careful consideration to the factual feedback and expertise of multiple stakeholders with different interests in lake levels.

What are the solutions for Lake Michigan-Huron?

On pages 6 and 7, read about AECOM's report on structural options providing protection to future generations from more extreme water level variability in Lake Huron-Michigan and Georgian Bay.

[1] Douglas A. Wilcox, Todd A. Thompson, Robert K. Booth, and J.R. Nicholas. Lake-Level Variability and Water Availability in the Great Lakes http://pubs.usgs.gov/circ/2007/1311/pdf/circ1311_web.pdf. Page 5 and 6

[2] *Final 2015. And Long-Term (1918-2015) Mean, Max, & Min. Monthly Mean Water Levels* (Based on Gage Networks) (feet, IGLD85). (2016, May 11). Detroit District of the United States Army Corps of Engineers. Retrieved from http://www.lre.usace.army.mil/Portals/69/docs/GreatLakesInfo/docs/WaterLevels/LTA-GLWL-English_2015.pdf. The metres are from the Great Lakes Water Level Dashboard: http://www.glerl.noaa.gov/data/dashboard/GLWLD.html. NOAA.

[3] *Final 2015. And Long-Term (1918-2015) Mean, Max, & Min. Monthly Mean Water Levels* (Based on Gage Networks) (feet, IGLD85). (2016, May 11). Detroit District of the United States Army Corps of Engineers. Retrieved from http://www.lre.usace.army.mil/Portals/69/docs/GreatLakesInfo/docs/WaterLevels/LTA-GLWL-English_2015.pdf. The metres are from the Great Lakes Water Level Dashboard: http://www.glerl noaa.gov/data/dashboard/GLWLD.html. NOAA. Also, some verbiage from:

[4] Douglas A. Wilcox, Todd A. Thompson, Robert K. Booth, and J.R. Nicholas. Lake-Level Variability and Water Availability in the Great Lakes. http://pubs.usgs.gov/circ/2007/1311/pdf/circ1311_web.pdf. Page 6

[5] http://www.ijc.org/en_/Great_Lakes_Water_Quantity and Wikipedia.

[6] Wikipedia, and International Joint Commission (2014). Lake Ontario St. Lawrence River Plan 201: Protecting against extreme water levels, restoring wetlands and preparing for climate change http://www.ijc.org/files/tinymce/uploaded/LOSLR/IJC_LOSR_EN_Web.pdf

[7] Douglas A. Wilcox, Todd A. Thompson, Robert K. Booth, and J.R. Nicholas. Lake-Level Variability and Water Availability in the Great Lakes. http://pubs.usgs.gov/circ/2007/1311/pdf/circ1311_web.pdf Page 6

[8] International Joint Commission (2014). Lake Ontario St. Lawrence River Plan 201: Protecting against extreme water levels, restoring wetlands and preparing for climate change. http://www.ijc.org/files/tinymce/uploaded/LOSLR/IJC_LOSR_EN_Web.pdf Page 13

[9] Rob Dorling, Reuven Shlozberg and Peter S. Spiro, Jun 25 2014. Low Water Blues. http://georgianbayforever.org/wp-content/uploads/2015/10/low-water-blues-exec-sum.pdf

[10] Wikipedia, and International Joint Commission (2014). Lake Ontario St. Lawrence River Plan 201: Protecting against extreme water levels, restoring wetlands and preparing for climate change http://www.ijc.org/files/tinymce/uploaded/LOSLR/IJC_LOSR_EN_Web.pdf

WATER LEVEL EXTREMES

There is a developing confluence of support to undertake work that will address water level extremes beyond historical norms in the Upper Great Lakes. This effort would focus on helping promote healthy ecosystems while protecting the economic interests of the region. Please read this timeline of events and turn to page 6 and 7 to read a summary of proposed solutions.

Water Level Extremes: Lake Michigan-Huron and Georgian Bay

1850s to 1960s	Dredging and historic mining create the loss of 53 cm to Lake Michigan-Huron.
1971 to 1989	Long period of high water.
1986	Highest recorded water at 177.50 m (Great Lakes Water Dashboard).
1987 to 2009	Long term declines due to climate change (9 to 17 cm), erosion of the St. Clair River (7 to 14 cm), glacial Isostatic adjustment (4 to 5 cm).
2013	Lowest recorded water level at 175.57 m.
2014	Highest July outflow into Lake Michigan-Huron from Lake Superior through the St. Mary's River since 1951.
2013 to 2015	Fastest rise of water in Lake Michigan-Huron.

Progress on Water Level Extremes: Finding the Cause, Finding Solutions

2005	The Georgian Bay Association* commissioned W.F. Baird and Associates to undertake a study of the St. Clair River and its contribution to the low water levels on Lake Michigan-Huron. The results of that report were useful to the International Joint Commission (IJC), and government subsequently expanded the IJC's reference to include the St. Clair River in its $17-million Upper Great Lakes Study.
2009	The final Report on Upper Great Lakes Water Levels to the IJC affirms there is merit in additional lake level control structures.
2012	The International Upper Great Lakes Study is released. It acknowledges the need for a detailed examination of additional lake level control structures and their possible contribution towards mitigating both the historic impacts of previously authorized project work and the ongoing and increasing impacts of climate change on the system.
2013	The IJC provided non-unanimous advice to governments that included the examination of structural options to address water levels but it was noted by Commissioner Pollack to be missing the significant climate change perspective.
2014	$18.8 billion cost to doing nothing about water level extremes. Findings in a GBF, Council of the Great Lakes and Mowat Centre report, "Low Water Blues."
	Proposed regulation 2014 to include healthy water level fluctuations within the historic ranges that promotes healthy ecosystems and protects the economic interests of the Region, which have evolved within those regimes. Without new tools to address the significant "out of band" impacts of climate change, there will be no adaptive management within the upper-middle Great Lakes. There will only be reactive adaptation.
2015	GBF supported NASA DEVELOP study shows a ten percent wetland loss in Southern Georgian Bay with prolonged low water levels, a four percent net loss.
	GBF retains global engineering firm AECOM to identify the most viable options and locations for extreme water level management.
Summer 2016	GBF and AECOM report, "Providing Structural Solutions for Adaptive Management in the Great Lakes: Creating Climate Resilience" is reviewed by key stakeholders and decision makers including the IJC. See a summary on page 6.

* The W.F. Baird and Associates report was funded through the GBA Foundation, which later became Georgian Bay Forever.

CREATING CLIMATE RESILIENCE

PROVIDING STRUCTURAL SOLUTIONS FOR ADAPTIVE MANAGEMENT IN THE GREAT LAKES

AECOM

STUDY BACKGROUND

As a a nonprofit organization dedicated to scientific research and public education, Georgian Bay Forever (GBF) has had a long-standing concern over the adverse impacts of pronounced water level fluctuations on Georgian Bay, Lake Huron and, more generally, the Great Lakes-St. Lawrence River System. An economic impact study partially funded by GBF, and conducted by the Council of the Great Lakes Region and the Mowat Centre[1] was released in 2014, which found for example, that declining water levels in the system will result in $18.82B in economic loss over the next 35 years if structural interventions do not take place.

Building on that work, GBF commissioned an internationally recognized water resources planning and engineering consultancy, AECOM Technical Services, Inc. (AECOM) to prepare a study to "provide viable structural options for the long-term climate resilient protection of water levels in the upper Great Lakes." The study addressed an unmet need acknowledged by the International Joint Commission (IJC) when releasing the 2012 International Upper Great Lakes Study (IUGLS): the need for a detailed examination of additional lake level control structures.

STUDY PROCESS

The study entailed the examination of over a dozen structural alternatives for lake level control within the Great Lakes-St. Lawrence River System. The alternatives are categorized as: Compensatory Structures (i.e., submerged sills, weirs, jetties, river training walls, wing dikes); Power Generating Structures (i.e., conventional hydroelectric dams, In-stream turbines); Adaptive Management Structures (i.e., inflatable flap gates, inflatable dams, control/sector gates); and "Other" Structures (i.e., ice booms, landfill and control gate structures). They include well-established, extensively researched structures, emerging technologies, and new ideas developed specifically to address lake level controls within the Great Lakes-St. Lawrence River System.

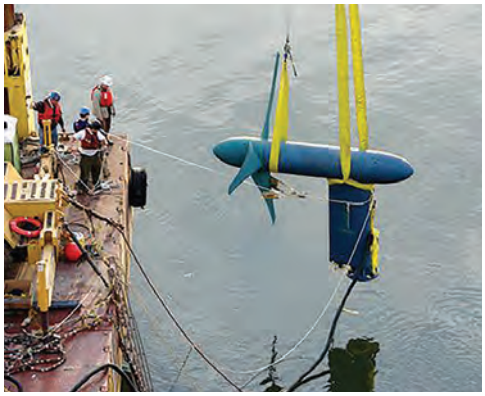
These various alternatives were examined in light of existing data and information, and subsequently evaluated on the basis of seven criteria that include performance, implementation feasibility, cost, regulatory requirements, climate resiliency, environmental impacts, and social/cultural considerations. The evaluation culminated in the selection of three alternatives for additional analysis and "concept level" development.

[1] Shlozberg, Reuven & Dorling, Rob & Spiro, Peter. Low Water Blues. *An economic Assessment of Future Low Water Levels in the Great Lakes and St.Lawrence River. Executive Summary.* ISBN 978-1-927350-77-5. Mowat Centre and Council of the Great Lakes Region. Retrieved at http://georgianbayforever.org/wp-content/uploads/2015/10/low-water-blues-exec-sum.pdf. The study was also partially funded by the Ontario government.

THREE OPTIONS

1. In-stream Turbines

In-stream turbines to be installed on the river bed of the Upper St. Clair River by the Blue Water Bridge, as well as upstream of the St. Mary's River Compensation Works. By reducing river flow when in operating mode, the turbines impact river hydrodynamics, increasing water levels upstream and decreasing levels downstream, as needs dictate. Power generation is a significant ancillary benefit.



In-stream Turbine, courtesy of Verdant Technologies. http://media.treehugger.com/assets/images/2011/10/verdant-power-turbine-j001.jpg

2. Inflatable Dams

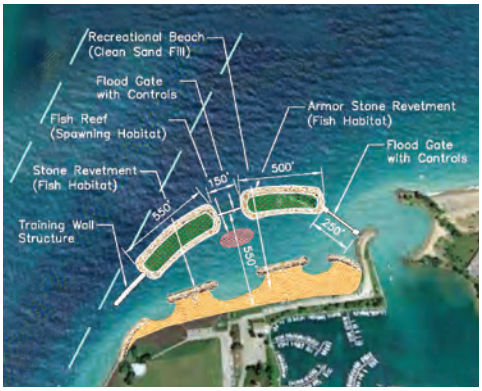
Inflatable dams to be installed in the St. Clair River at Stag and/or Fawn Islands. When the inflated dams are operational, river flow is reduced with a resultant increase in upstream water levels. During higher than desired levels, the dams are deflated to allow for increased river flow.

Inflatable dams-Adam Bower Dam Deflation. Adam T Bower, image courtesy of NOAA, http://www.erh.noaa.gov/marfc/100_0284a.jpeg

3. A Park Fill/Control Gates System

A park fill/control gates system to be constructed at the mouth of St. Clair River. The proposed structure is composed of two new islands (involving stone revetment, sand fill, topsoil and landscaping) and two flood control gates that will be adjusted, as needed, to reduce river flow and increase upstream water levels. The gates can be opened to allow for increased river flow when water levels are higher than desired. An important ancillary benefit is the creation of a park offering the public many opportunities for water-based recreational activities.

The analysis of these three alternatives was complemented by conversations with various interested parties to gain perspectives on the notion of additional structural controls for Georgian Bay and Lake Huron.



Park Fill and Control Gate System- Mouth of St. Clair River (aerial courtesy Google Maps)

STUDY OUTCOME

Based on previous modeling work, evaluation outcomes and "concept level" analyses, it was found that these three structural alternatives (In-stream Turbines, Inflatable Dams, Park Fill and Control Gate System) have potential merit as additional lake level control mechanisms. Their individual benefits are substantial and, if implemented collectively, will be even more pronounced. Singly or in combination, they address the GBF goal for the "long-term climate resilient protection of the water levels of the upper Great Lakes." For example:

Deploying an array of large **In-stream Turbines** (56 in total) in the St. Clair River near the Blue Water Bridge will raise water levels by as much as 9 cm (3.5 inches) under average flow conditions, according to a study by the National Research Council (2001). If the number of turbines totaled 151 in that general location, upstream water levels will increase by 19 cm (7.5 in). Power production is estimated at 1.3 MW for the former and 2.5 MW for the latter. Additionally, an in-stream turbine array upstream of the St. Mary's River Compensation Works would complement the St. Clair River array in terms of both lake level control capability and power generation capacity. This emerging technology has been applied in multiple locations in the United States and overseas. Primary applications to date are for "clean" power generation, but modeling exercises have also demonstrated applicability for water level control purposes.

Installing **Inflatable Dams** at Stag and Fawn Islands in the St. Clair River will raise upstream water levels by an estimated 21 cm (8.3 in). This increasingly popular semi-adjustable technology has been successfully installed in multiple states as well as overseas. Composed of a highly durable membrane and permanent sill, this structure is known to perform well in extreme weather conditions. It features automated control system technology as well as remote monitoring and controls to facilitate inflation/ deflation according to water level variations.

Constructing a **Park Fill and Control Gate System** at the mouth of the St. Clair River would raise upstream water levels by as much as 19 cm (7.5 in). This alternative has additional benefits, as it entails the construction of two islands that also provide upland habitat, fish spawning structure and water-based recreational opportunities. Control gates are readily adjustable based upon water level variations.

Individually and collectively, these structural alternatives have the potential to provide significant relief to pronounced fluctuations in water levels. They are proven technologies readily adaptable to changing conditions: each can be quickly activated or deactivated based upon current and anticipated water levels.

NEXT STEPS

All three of these structural alternatives have significant strengths: they are proven technologies in freshwater systems, are adaptable to changing climate and water level conditions and, compared to other alternatives investigated, have favourable environmental and socio-economic characteristics.

Although these technologies are promising, they have only been examined at the conceptual level based on existing data and information. Data gaps and information needs must be fully addressed to ascertain, in detail, their potential applicability to the Great Lakes. This includes additional research and modeling to determine, with a degree of precision, factors such as their individual and collective water level control capabilities, desired engineering and design features, installation and operational costs, regulatory considerations, and perspectives of affected parties.

Action recommendation

It is recommended that the International Joint Commission and the two federal governments support detailed design work on these alternatives to better understand their potential to augment existing lake level control plans, procedures and structures.

SHORT TERM WATER LEVELS OUTLOOK PLAYING WITH GLOBAL WEATHER

EL NIÑO AND LA NIÑA

Update - In the new Oct forecast after this was produced, La Niña is no longer forecast for the fall and winter. Read the new October forecast at http:/bit.ly/2dmztI1

El Niño, the Little Boy, has been playing with global weather and that of the Great Lakes over the last year.

El Niño occurs when water temperatures increase to abnormal levels in the Eastern Pacific Ocean. Generally, this condition leads to above average temperatures and drier conditions in many parts of the world, sometimes with catastrophic results as occurred in India, Thailand and California. Combined with the effects of global warming, we have seen the "…highest recorded global temperature, including land and ocean, occurring earlier this spring. Fifteen of the highest monthly temperatures ever recorded have occurred in the last 15 months." [2]

The Great Lakes certainly experienced a warm winter, with little ice, and less snow

Warmer air temperatures and warm water temperatures resulted in little evaporation (which occurs more often when there is greater contrast between the two). Lake levels reached record lows in 2012 and 2013 followed by rapid rises to above average levels for Lake Michigan-Huron and Georgian Bay.

But the Little Boy is getting tired

Often strong El Niños are followed by their opposite called La Niña, or the Little Girl. La Niña results when the Pacific waters cool to below neutral temperatures. Historically, this tends to lead to a drop in the global temperature and often wetter conditions for most areas (while drier in some). Some drought-plagued regions could benefit, while other parts of the world risk increased severe storms. Five out of seven hurricanes or tropical storms in the last decade with $1-billion (U.S.) plus in damage occurred during La Niña years between 2008 and 2011.[3]

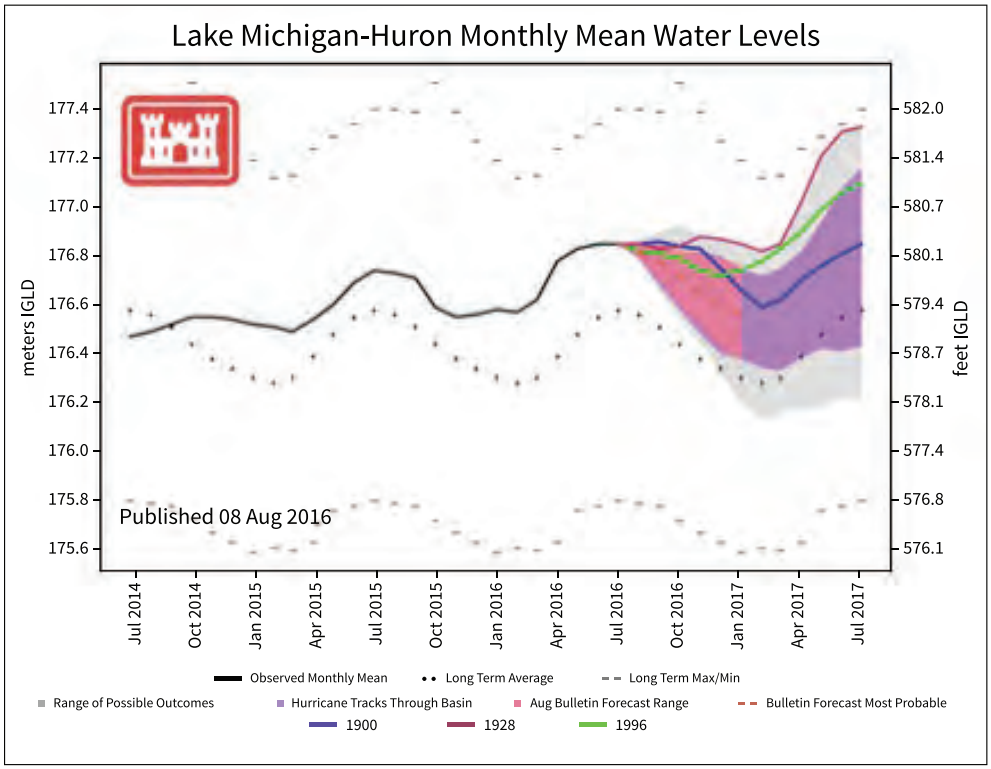
While there is no certainty in weather prediction due to the many factors affecting regional weather, the National Oceanic and Atmospheric Administration (NOAA) is predicting more than a 50% chance of La Niña occurring by late fall. For the Great Lakes this could mean more precipitation as snow, longer snow pack and more ice. [4]

NOAA's prediction depends on computer simulation models with many different inputs, the most important variables for lake levels being overlake precipitation, overlake evaporation and rainfall-induced runoff. From July 2016 to July 2017, the 12-month outlook with El Niño followed by La Niña is that water levels will generally be above long-term averages.

From July to January 2017, the most probable bulletin forecast (brown dotted line) shows water levels over those months roughly between 176.8 m (580.1 ft.) on the high side to 176.5 m (579.2 ft.) on the low side. Water levels in the fall tend naturally to lower. The outlook from January 2017 to July 2017 shows a grey band range from extremely high water to dipping slightly below average, in the winter months.[5] NOAA notes, "In many past strong El Niño years, the fall following the event was characterized by a higher rate of over-lake evaporation than average. If that comes to pass, we may see seasonal lake levels decrease more quickly in November and December of 2016." [6]

Weather vs. Climate?

Weather is short term, climate is longer term weather patterns tending to stretch over decades. While weather has been increasing water levels in the short term, most climatologists predict longer term declines over the next 35 years in water levels for Lake Michigan-Huron with the possibilities of short term highs. Swings will be more rapid.



[1] Miller, P., Perry, J. (2016, June 15) El Niño is dead but La Niña is coming: Are we ready? *Extreme Weather, CNN.* Retrieved from http://www.cnn.com/2016/06/15/weather/weather-el-nio-dead-la-nia-coming/index.html

[2] Alexander, K. (2016, June 26) Adios El Nino; Hola La Nina: Michigan starts summer with high temperatures and lake levels but little rain—according to state climatologist *MLive Michigan* Retrieved from http://www.mlive.com/environment/index.ssf/2016/06/adios_el_nino_hola_la_nina_mic.html

[3] Miller, P., Perry, J. (2016, June 15) El Niño is dead but La Niña is coming: Are we ready? *Extreme Weather, CNN.* Retrieved from http://www.cnn.com/2016/06/15/weather/weather-el-nio-dead-la-nia-coming/index.html

[4] Great Lakes Water Level Outlook (2016, July) *U.S. Army Corps of Engineers.* Retrieved from http://w3.lre.usace.army.mil/hh/ForecastData/12MonthSimulation/WLOutlookSummary.pdf

[5] Great Lakes Water Level Outlook. (2016, July edition) *U.S. Army Corps of Engineers.* Retrieved from http://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Water-Levels/Water-Level-Forecast/Water-Level-Outlook/

[6] Water Levels of the Great Lakes. (2016 February). Retrieved from http://www.glerl.noaa.gov/pubs/brochures/lake-levels/ lakelevels.pdf

WORKING ON WATER PROTECTION

By David Sweetnam

LISTENING TO FIRST NATIONS

From Tobermory around the Bay to Manitoulin, from the St. Mary's River to Little Current, there is an awakening of our Georgian Bay community underway. GBF was honoured to be invited by Marilyn Capreol, from Shawanaga First Nation, to participate in the Anishinaabe First Nations water conference. We were in attendance August fourth and fifth and witnessed the welcoming of the paddlers arriving all the way from Lake St. Clair in the early morning mists on the shore of the St. Mary's River—a special experience indeed. The community came together with friends to begin a traditional process that starts with critical information gathering: talking, listening and learning about the water.

We need to hear their stories to help us focus on what we should be aspiring to restore and protect. Our First Nations story tellers have much to share about the ecosystems that have been so adversely impacted by the past 300 years. The negative legacy that we are still struggling with includes the extirpation of 10 of the 12 varieties of Lake Trout, the decimation of fish stocks by overfishing and the dumping of chips and barks in the fisheries coastal habitats by the timber industry. In attendance was First Nations story teller Josephine Mandamin, known as grandmother "Water Walker." Josephine walked the shorelines of the Great Lakes raising awareness about pollution and was a spry inspiration to all in attendance!

CONTINUING THE FIGHT AGAINST PHRAGMITES

Wading chest deep into Georgian Bay to fight invasive Phragmites has also once again made for a busy summer. As we had hoped, through expanded programs we easily removed double the amount realized by last summer's efforts. Many of the stands that have been expanding for the past few summers have finally been eradicated over the first of several years of concerted community effort. However, some remote infestations have been spotted in the Magnetawan River and even north in the Garden River First Nation. We must renew our efforts next year to continue these critical eradication programs.

Left: First Nations Josephine Mandamin "Water Walker"
Go to https://youtu.be/wPega7E8Lhg to listen to her experience walking around the Great Lakes. (Photo: Youtube)

Right: David trains the Tay community to fight invasive Phragmites

THANKS TO ALL PHRAGBUSTERS!

Honey Harbour. GBF supported the Honey Harbour Association's Ambassador Program by training 2 students, Kristin Koetsier and Robert Davis, to educate and train the community to identify and remove invasive Phragmites. For more details, please visit http://gbf.org/2016/08/16/honey-harbour-phragmites-fight-2016/

Tay. GBF supported the invasive Phragmites fighting efforts of Tay Township and the wonderful Tay volunteers. For more details, please visit http://gbf.org/2016/08/29/tay-takes-on-phragmites/

These communities and amazing volunteers also fought Phragmites with GBF support. Bayfield-Nares Islanders Association, Cognashene, Collingwood, Copperhead and Sans Souci, Craigleith Provincial Park and Wasaga Beach Provincial Park, Go Home Bay/Madawaska Club, Mill Lake, Pointe Au Baril/Sturgeon Bay, Tiny/Wymbolwood Beach, Woods Bay.

DRAWN TO THE PRISTINE WATERS OF SANS SOUCI

By Colette Thomson

> "There is absolutely no better piece of water in the world than Georgian Bay."

There is no doubt about it, Cameron Wardlaw knows water. In his teenage years, he worked in the boating business at the age of nineteen and purchased Skyline Marina in his early twenties. He spent the next fifty-four years as the proud owner and president of Skyline Marina until his retirement in 2013.

Having experienced cottage life as a child, Cameron dreamed of one day owning his own place. He was drawn to the vibrant and unique cottage community of San Souci in Georgian Bay and was excited by the prospect of boating from the San Souci & Copperhead Association (SSCA) dock to an island retreat. Purchasing in 1978, his San Souci dream was realized.

Cameron purchased his cottage from the Collins family, the original owners since the 1940s, who had lovingly called it "Grumblenot". Located at the southern end of Sans Souci on Hewson Island, the front of the cottage enjoys a western exposure while the back faces south. Described as magnificent with impressive dimensions, what really sold Cameron on this specific cottage was the stunning open view of the water. It is still paradise to him—its pristine water and spectacular sunrises and sunsets.

In 1988, the renovations began, including updates to the cottage and major changes to the property. He tore down the ice and boat houses, originally from the 1940s and actually located on the north end of Ardwell Island. They were replaced by a three-slip boathouse, better suiting his boating lifestyle and allowing parking space for guests.

Today, Cameron is still in awe of the Sans Souci cottage area and is very proud of the thriving community it has become. It continues to be vibrant and unique which first attracted him and where he has enjoyed both his Canadian and American neighbours and friends, cherishing the many long-term relationships he has made throughout his cottage years.

Committed to protecting Georgian Bay for future generations.

Cameron is pleased to see so many young families and new people starting their own traditions and memories on Georgian Bay. It takes respect for the weather and water to be on this part of the Bay and people are becoming more conscious of their environment and in protecting what they have.

> "Cottagers are really caretakers of properties and the water for themselves and for future generations to come."
>
> – Cameron Wardlaw.

Thank you.

Georgian Bay Forever is truly grateful to Cameron Wardlaw and our many other donors for continuing to support GBF, enabling important projects and research that help protect the Bay. Please visit our website at gbf.org to learn more about how you can continue to help make a difference.

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