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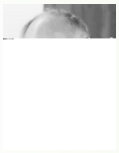
E ARE PLEASED TO RECEIVE this report containing options for separating the Great Lakes and Mississippi River basins in the Chicago Area Waterway System, and look forward to reviewing it in detail. The report, led by the Great Lakes Commission and the Great Lakes and St. Lawrence Cities Initiative, is a critical step forward that lays a foundation for continued dialogue on how to safeguard the Great Lakes and Mississippi River watersheds from Asian carp and other aquatic invasive species. The report correctly concludes that any credible solution must also sustain the system's ability to support recreation, manage fooding, and transport people and goods.

The report refects an emerging vision for Chicago's waterways, a future that includes cleaner water, less fooding and more ef- fcient transportation. We believe this report, and the collaborative process through which it was developed, will help us achieve this goal while preventing the movement of Asian carp and other aquatic invasive species through Chicago-area waterways. Through our continued work together, we can advance a solution that benefts the Chicago region and the Great Lakes and Mississippi River basins as a whole.



Hon. Pat Quinn
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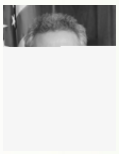

Hon. Rahm Emanuel
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Hon. George Heartwell
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Separating the Great Lakes and Mississippi River Basins in the Chicago Area Waterway System

THE GREAT LAKES COMMISSION AND THE Great Lakes and St. Lawrence Cities Initiative led a project to develop and evaluate alternatives for physically separating the Great Lakes and Mississippi River basins in the Chicago Area Waterway System to prevent the movement of Asian carp and other aquatic invasive species (AIS). This report summarizes the results of the project and shows that separation can be achieved while also maintaining or enhancing water quality, food management, and transportation. The engineering and economic analyses suggest that separation is feasible and provide a solid foundation on which further dialogue to advance a long-term solution to the AIS threat can proceed. Separation is defned as stopping the fow of water by placing physical structures at key points in the waterway system.

The Chicago Area Waterway System (or CAWS) includes an approximately 130-mile[1] array of natural and constructed rivers, canals, locks and other structures in Chicago and northwest Indiana. Constructed beginning in the 1890s, the waterway system diverted water from Lake Michigan and created a connection across the mid-continental divide to the Mississippi watershed. There are fve connections between the CAWS and Lake Michigan, and the Chicago Sanitary and Ship Canal connects the system to the Illinois River and the Mississippi River watershed. The CAWS provides important benefts to the Chicago region, including conveying treated wastewater, supporting commercial shipping, managing food water, and moving recreational boats and tour boats. However, the system faces signifcant challenges in these areas and has the potential to better serve residents, businesses and visitors.

Separation is needed to prevent the movement of Asian carp and other AIS between the Great Lakes and Mississippi River basins in the Chicago-area waterways. Asian carp, in particular, are an imminent threat; in 2010 a bighead carp was collected from Lake Calumet, just fve miles from Lake Michigan.[2] Recent research confrms that they can survive and spread in the Great Lakes, and that the CAWS is the most likely point of entry.[3] Current control efforts for the carp are vital, including the electric barriers in the Chicago Sanitary and Ship Canal. However, these efforts are incomplete, costly to maintain, and vulnerable to failure. The electric barriers will not st ? o d rpoi ✕ o l h otainre. h

Separation barriers: $109 million
Flood management: $2.98 billion
Water quality: $290 million to $5.85 billion
Transportation: $560 million
Timeline: Phase I: One-way barrier with flood water bypass (lake to river) and all transportation improvements completed by 2022.
Phase II: Two-way barrier completed by 2029
Total Investment: $3.94 - $9.5 billion

Separation barriers: $140 million
Flood management: $1.89 billion
Water quality: $180 million to $1.2 billion
Transportation: $1.04 billion
Timeline: Phase I: One-way barrier with flood water bypass (lake to river) and all transportation improvements completed by 2022.
Phase II: Two-way barrier completed by 2029
Total Investment: $3.26 - $4.27 billion

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IN THE LATE 1800s CHICAGO CONFRONTED a public health crisis caused by untreated sewage in the Chicago River fowing to Lake Michigan, contaminating drinking water for a growing metropolis. Chicago residents were becoming sick and dying from typhoid and other diseases as a result. Something had to be done.

City leaders devised a bold solution to reverse the fow of the Chicago River and send the city's waste away from Lake Michigan. This required connecting the Chicago and Illinois rivers and sending the city's waste to the Mississippi River. This connection event Ğ i ę Ĥ ٦ oniss ene@ n

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THE CAWS FORMS A CONTINUOUS
hydrological connection that exposes the Mississippi

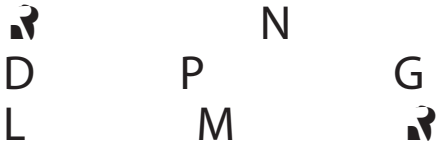
to reproduce and establish populations.[18] Taken collectively, this research demonstrates that the risk of Asian carp establishing populations in the Great Lakes basin is signifcant, potentially severe, and certainly very real.

Currently, a system of electric barriers in the Chicago Sanitary and Ship Canal (CSSC) is a key line of defense protecting the Great Lakes from Asian carp invading through the CAWS. The barriers use steel cables secured to the bottom of the canal to disperse a low-voltage electric feld. The electric feld is uncomfortable for fsh and they do not swim across it. While they are an important part of a broader defensive strategy, the electric barriers will not stop many other species – especially viruses and plants – from passing through the CSSC, and their efectiveness in blocking small Asian carp has been questioned. In addition, a critical inherent defciency is their inability to stop the downstream movement of live organisms, which, even if stunned by the electric current, can still pass through with the fow of water. The barriers also require ongoing maintenance and periodic shut downs, and cost $8 million annually to operate.[19]

The efectiveness of the electric barriers has been called into question by the detection of Asian carp DNA in the CAWS. Since federal agencies began using this new environmental DNA (or eDNA) monitoring technique in 2009, more than 90 positive samples of carp DNA have been detected between the electric barriers and Lake Michigan (that is, on the "wrong" side of the barriers).[20] A positive eDNA sample indicates the presence of Asian carp DNA and the possible presence of live fsh. While the technique has limitations, it is an important "early warning" tool.

Electric barriers are a partial defense, but they do not provide a reliable, long-term solution that safeguards both the Great Lakes and Mississippi River watersheds from invasion by all potential AIS through the CAWS. The U.S. Army Corps of Engineers itself has acknowledged that "the electric barrier system is considered [an] experimental and temporary fx to this problem…"[21]

In response to growing indications in 2009 that Asian carp had bypassed the electric barriers, some Great Lakes



showing Lake Shore Drive

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WITH THIS CHALLENGE IN MIND, THE Great Lakes Commission and the Great Lakes and St. Lawrence Cities Initiative launched a project to develop alternatives for physical separation in the CAWS. The goal, in brief, is to illustrate how separation can be achieved while maintaining or enhancing other beneficial uses of the waterway system. Toward this end, the project developed three alternatives for physical separation that

- Prevent the passage of Asian carp and other aquatic invasive species through the CAWS between the Mississippi River and the Great Lakes;
- Improve water quality throughout the CAWS;
- Improve the ability of the CAWS to protect against flooding; and
- Improve the use of the waterways for commercial transportation and recreational boating.

A key premise of the project is that, to be successful, separation must support improvements to the CAWS while also preventing the movement of all AIS between the Great Lakes and Mississippi River basins. An additional project goal is to support and help accelerate the

THE FOLLOWING ILLUSTRATES KEY ELEMENTS of the Mid-System Separation Alternative that are needed to maintain or enhance water quality, flood protection and transportation in the CAWS while preventing AIS transfer between the Great Lakes and Mississippi River basins. The other two alternatives include similar elements.

could range from a sheet pile or impermeable land bridge without cargo or recreational boat transfer capability on the Little and Grand Calumet rivers, to a barrier with intermodal cargo transfer facilities and boat lifts on the Calumet River at Lake Calumet. The Chicago River barrier could include cargo and boat transfer equipment, depending on the need.

on the Chicago River will prevent flooding until completion of the Tunnel and Reservoir Plan (TARP) in 2029, when it will be upgraded to block the flow of water in both directions. The one-way barrier will prevent AIS movement into Lake Michigan. Flows over the barrier from lake to river would occur infrequently to accommodate large storms.

from the CAWS will prevent flooding during large storms until TARP's completion. Locks and other control structures will remain closed except when backflows are needed to release flood water to Lake Michigan.

at the North Side Wastewater Treatment Plant (WWTP) will ensure compliance with water quality standards and allow discharges to Lake Michigan.

will prevent stagnant water on either side of the barriers. This could be provided by rerouting WWTP effluent or providing water from Lake Michigan to create flow.

within one mile on either side of the CAWS will separate

The following are important factors to keep in mind when considering the alternatives:

The alternatives were selected because they illustrate a range of impacts and opportunities that result from placing barriers at different locations in the CAWS. They are intended to clearly contrast each other and illuminate their respective benefits and disadvantages.

The maps of the alternatives are not intended to show the precise location for each barrier, but the general vicinity where they would be located.

The project's purpose is to provide credible information and a sound analysis of separation alternatives to inform and advance the public dialogue. Using this information, decisionmakers will be equipped to begin considering a preferred alternative.

While the report does not identify a preferred alternative, they clearly differ in their advantages and disadvantages. The report shows, for example, that the Mid-System Alternative is far less expensive and has advantages over the other alternatives. The Great Lakes Commission and the Great Lakes and St. Lawrence Cities Initiative recognize this, but believe it is important to present three different alternatives in order to better inform the public dialogue.

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THE FOLLOWING IS A SUMMARY OF THE separation alternatives, emphasizing the barrier locations; improvements for food management, water quality and transportation; and the timeline for phased implementation. This reflects only the improvements and associated costs required to make separation successful; it does not include investments that are already planned or anticipated. A detailed evaluation of the alternatives is provided in the project's technical report. It is important to note that the costs of the physical barriers are a very small proportion of the overall costs of separation, accounting for no more than 3 percent of total costs.

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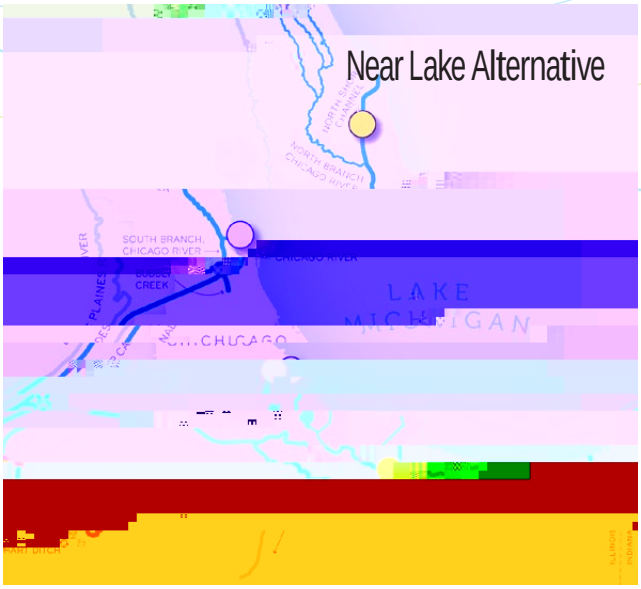
The Near Lake Alternative requires five barriers located north of the North Side WWTP on the North Shore Channel, at the mouth of the Chicago River, at the mouth of the Calumet River, and on the Grand Calumet and Little Calumet rivers. This alternative poses significant challenges for flood management and transportation. The outlets to Lake Michigan would no longer be available, requiring construction of three tunnels to convey stormwater to prevent flooding. Freighters coming from Lake Michigan (known as "lakers") would no longer have access to ship terminals on the Calumet River and Lake Calumet, requiring construction of a new port on Lake Michigan.



The Near Lake Alternative would improve the region's resiliency to large floods and provide stormwater management capability equal to or better than existing capacity. Water quality in the CAWS would remain largely unchanged, except for benefits from already-planned improvements to WWTPs. There would be no more wastewater or CSO discharges to Lake Michigan except during large storm events. Barges, recreational vessels and tour boats would have unrestricted movement within the CAWS, but direct access to Lake Michigan would no longer be available. Deep-water vessels coming from Lake Michigan would no longer have access to port facilities on the Calumet River and in Lake Calumet. However, a modern, full-service port with consolidated terminals, intermodal facilities, and recreational boat facilities would be constructed at the mouth of the Calumet River. This could help reduce congestion on area roads and rail lines, increase container traffic in the region, and improve the intermodal efficiency of the freight system.

Separation will generate significant benefits for the Chicago area and the Great Lakes and Mississippi River regions in general. While many of these benefits are difficult to quantify, they are important to consider. It is also noteworthy that the costs of separation will be incurred over a limited timeframe, while the benefits

These documented costs can be used to illustrate one dimension of the long-term benefits that would be generated if similar costs from future AIS are avoided by implementing separation.

- Avoiding $150 million in annual costs from AIS with similar impacts to those introduced to the Great Lakes by ballast water would generate approximately $400 million to $2.8 billion in long-term savings
- Avoiding $500 million in annual costs from a future AIS with impacts similar to zebra mussels would generate approximately $1.4 to $9.5 billion in long-term savings

As envisioned, separation will generate significant, long-term cost savings. For example, with the Great Lakes commercial and sport fishery generating $7 billion in economic activity annually,[64] the potential for avoiding economic damage from future AIS invasions is clearly evident. The project's technical report concludes that "stopping a single AIS from transferring between basins could avoid billions of dollars in economic loss."

Other benefits from separation, some of which could not be quantified, include

- Over $400 million in economic benefits is estimated from expanded shipping of containers on barges in the CAWS.
- Local communities will benefit from reduced flooding of basements, streets and businesses as a result of infrastructure investments that will increase capacity in the CAWS to better handle large storm events.
- Improved water quality in the CAWS will generate benefits for local residents. While these benefits are not quantified, studies by U.S. EPA have estimated the value of improvements generated by the Clean Water Act to be approximately $11 billion annually.[65]
- Avoiding the costs of operating and maintaining shipping locks on the CAWS and conducting AIS-related research and prevention are estimated at over $100 million.
- Like any major infrastructure project, separation will create jobs and generate economic activity. It is estimated that separation will generate between 2,900 and 7,500 jobs annually over the approximately 50-year period evaluated in the report.

Another approach to considering the costs and benefits of separation is to determine the cost per household in the Great Lakes and Mississippi River basins and consider if sufficient "willingness to pay" exists to support the effort.

With expansion of the Panama Canal in 2015, the Chicago region could attract new shipping business and become a primary hub for waterborne commerce. Anticipating a growth in container vessels passing through the Panama Canal, Gulf Coast ports are planning to significantly increase their container capacity over the coming decade.[66] Some of these containers can be transferred to barges and moved up the Mississippi and Ha[illegible]6

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THIS REPORT SHOWS THAT SEPARATION is feasible and can be accomplished in a way that maintains or enhances other vital uses of the Chicago waterway system. It also illustrates how the management and use of the waterways is evolving and how upcoming investments can help facilitate separation and reduce its

	# Continual connection		

	aquatic invasive species
	Calumet-Saganashkee Channel
	Chicago Area Waterway System
	Chicago Region Environmental and Transportation E□ciency Program
	combined sewer overflow
	container-on-barge
	Chicago Sanitary and Ship Canal
	environmental deoxyribonucleic acid
	Great Lakes and Mississippi River Interbasin Study
	Metropolitan Water Reclamation District of Greater Chicago
	Tunnel and Reservoir Plan
	[illegible]

ENDNOTES

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ACKNOWLEDGMENTS

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