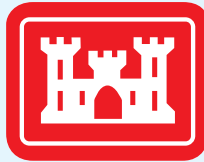


February 2010

DRAFT

ASIAN CARP Control Strategy Framework



United States Coast Guard
U.S. Department of Homeland Security



CONTENTS

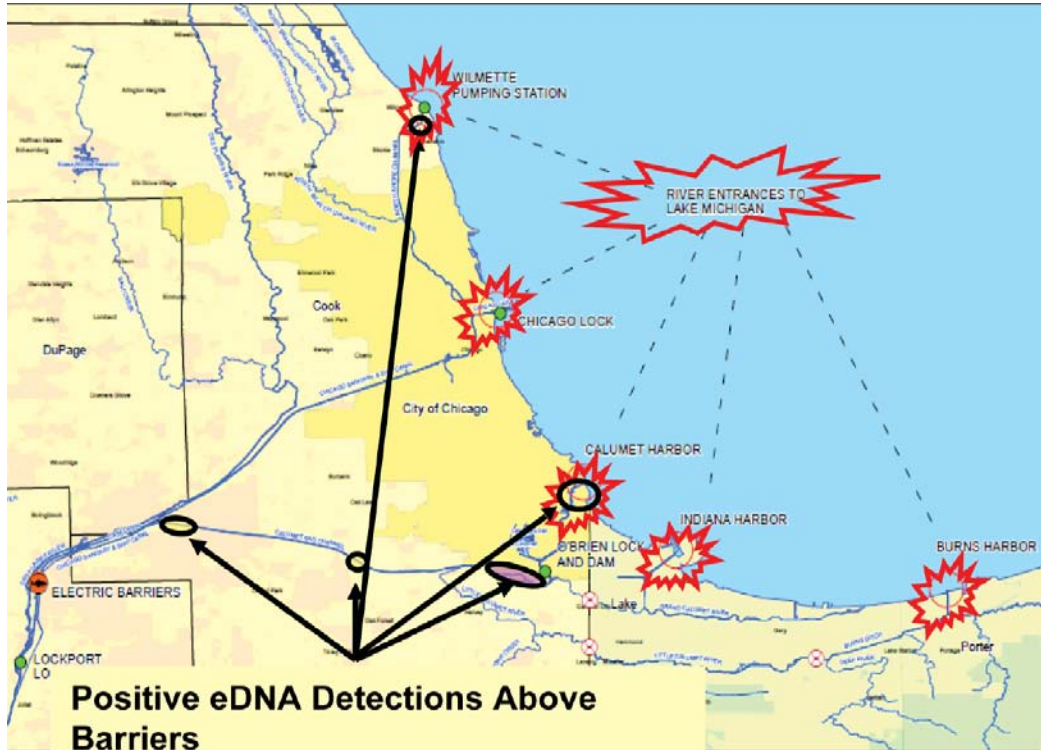
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EXECUTIVE SUMMARY

The Great Lakes food web has been significantly degraded in recent decades and years by aquatic invasive species (AIS). The migration of Asian carp into and through the Illinois and Des Plaines River and Chicago Area Waterway System (CAWS) is the most recent and likely most acute AIS threat facing the Great Lakes today. Exhibit 1 below highlights the area of focus, the electric barriers in relationship to Lake Michigan, specific entry points into Lake Michigan, and recent locations where Asian carp environmental DNA (eDNA), which indicates the potential existence of Asian carp species, was present in the water.

Exhibit 1. Area Map and eDNA Locations



This draft Asian Carp Control Strategy Framework (Framework) is a dynamic document, reflecting an ever-increasing body of knowledge gathered from ongoing research and monitoring, as well as the December 2009 deployment of federal, state, local, and Canadian resources to conduct an eradication effort in the Chicago Sanitary and Ship Canal (CSSC). Many actions described in this Framework, such as research and feasibility studies, are expected to provide additional data that may inform future management decisions. However, the main objectives of this initial Framework are to:

- Establish the need for participating agencies to act urgently to prevent Asian carp from becoming established in the Great Lakes.
- Integrate and unify the future actions of participating agencies.
- Transition from a single point defense (electric barriers) to a multi-tiered approach.
- Provide general direction while recognizing that the pattern of Asian carp migration demands a measure of flexibility on the part of participating agencies to act.
- Recognize potential hurdles that might complicate Framework implementation.
- Suggest an approach for stakeholders and other agencies to actively collaborate in future efforts.

The best science available underscores this Framework. According to one of the leading scientists on the subject, University of Notre Dame Professor David M. Lodge, the “establishment of a self sustaining population of either silver carp or bighead carp in Lake Michigan--what biologists would refer to as an invasion--is not a foregone conclusion.” As such, widespread agreement exists among stakeholders that minimizing the escape of Asian carp into Lake Michigan is critical to reducing the probability of such an establishment.

In December 2009, while the U.S. Army Corps of Engineers’ (USACE) Barrier IIA was down for maintenance, over 400 responders from local, state, provincial, federal and binational organizations came together to execute the successful effort to use chemical applications to defend the CSSC against carp migration. In that spirit, this document provides actions (encompassing actions that are or will occur and potential action options) through which agencies can collaborate. This Framework is designed to be inclusive, allowing new agencies to engage in the process of implementing, developing and consulting on other possible control actions.

The Framework presented here includes a matrix of action items that are currently underway or will be implemented. While several of the actions will be conducted by a single agency or governmental unit, most demand cooperation between two or more agencies. The proposed action items are grouped into two categories: (1) Short-term Actions and (2) Long-term Actions. These actions will be in full compliance with all National Environmental Policy Act (NEPA) regulations. Environmental considerations will be integrated into the decision making process and appropriate environmental review will be prepared as necessary for all proposed actions.

To address the clear threat Asian carp pose to the Great Lakes, the federal, state, and local strategy will be to move quickly on proven solutions, and consider, develop, and test potential solutions and employ those that are most sound.

Short-term Actions

There is urgent need to reduce the number of carp that may be available to infiltrate Lake Michigan. As such, the following actions are either underway or are expected to commence by May 15, 2010.

1. Operations to confirm and reduce carp populations
 - Utilize chemical, netting and other mechanisms in known eDNA priority zones (Cal-Sag Channel, O'Brien Lock and Dam, Wilmette pumping station, and Calumet Harbor).
 - Ensure Rotenone (a piscicide) supplies and fishing capabilities are adequate for possible responses.
 - Prepare for immediate rapid response operations by procuring equipment, providing training and exercises for personnel, and creating stand-by capability for rapid deployment.
2. Increased fish collection effort for confirmation of eDNA results and carp populations
 - Deploy more frequent and intense harvesting methods in conjunction with rotenone applications where feasible and coordinate efforts with eDNA sampling to increase likelihood of successful collection.
3. eDNA indicator refinement
 - Increase capacity to 120 samples per week by April of eDNA results to guide efforts.
4. Modified structural operations
 - Change the manner in which existing CAWS structures, such as locks & dams, sluice gates and pumping stations, are operated in combination with other management actions, to impede the migration of Asian carp into the Great Lakes. This concept is likely to be incrementally executed as capabilities become available. The impacts of this as well as the potential

efficacy of any actions will be evaluated pursuant to applicable laws such as the National Environmental Policy Act

- Implement an approach with three phases
 - i. Phase 1: Concept Development – Integrate agencies' efforts to develop methods to suppress Asian carp population growth while USACE and U.S. Coast Guard (USCG) simultaneously determine how to optimize/reduce the number of lock openings, and the Metropolitan Water Reclamation District (MWRD) considers how to operate the Wilmette Pumping Station to impede Asian carp movement. This will occur after engaging the navigation industry. The goal for this phase is to complete concept development and recommended actions by early March 2010;
 - ii. Phase 2: Initial Implementation – Execute modified structural operations as quickly as possible once methodologies are ready, with initial elements underway by April 30, 2010;
 - iii. Phase 3: Additional Implementation – Adjust initial methodologies based on field results to sustain longer term operations. In conjunction with continued population suppression, continue to field new methodologies as they become available, such as acoustic bubble barriers or electric barriers, as well as addition of screens at sluice gates and bulkheads for use during flood damage reduction operations with goal of full implementation by the end of 2010.
- 5. Construct emergency engineering measures to block passage of water and fish between (1) Des Plaines River and CSSC and (2) Illinois and Michigan (I&M) Canal and CSSC.
- 6. Increased biological control efforts
 - With increased funding and capacity, expedite research on targeted control, including pheromone attractants, disruption of spawning behavior, and decreasing egg viability.
- 7. Barrier operations
 - Sustained operations of the current electric dispersal barriers and construction of the new planned electric barrier, both important impediments to the Asian carp expansion in the Great Lakes.

Long-term Actions

The Long-term Actions are also integral to the success of preventing Asian carp from establishing a self-sustaining population in Lake Michigan. Examples of actions are shown below in five sub-categories; however the set of proposed actions, listed later in this document, is more comprehensive.

1. Structural:
 - Efficacy studies to investigate the construction and implementation of additional barriers such as electric, light, and/or bio-acoustic bubble barriers
2. Chemical:
 - Additional possible rotenone applications where testing suggests Asian carp presence
3. Biological:
 - Suppression of Asian carp populations in CAWS and in downstream areas utilizing a variety of methods
 - Development of biological controls similar to those used for lamprey suppression
4. Operational:
 - Sustained operations of electric barriers
 - Enhanced monitoring programs via traditional or new methods

5. Other:

- Controlled lock operations using chemical and other means to reduce migration
- Promotion of Asian carp market development
- Integration of the Great Lake States, Provincial, and Tribal capabilities and expertise into the proposed framework actions
- Technology enhancement programs

Funding sources, detailed later in this document, have been secured for each of these proposed actions to further underscore the seriousness of Asian carp movement into the Great Lakes. This collection of action items represents the collaborative efforts of the participating agencies and is what is being done to defend against Asian carp migration into the Great Lakes. While recognizing the severity of the situation, efforts have been made to maintain inter-basin movement of boat traffic. Please refer to sections [2.1.4](#) and [2.2.3](#) for further narrative the proposed action for sustained lock operations.

In addition to the above actions, the U.S. Fish and Wildlife Service's (FWS) Midwest Region is currently coordinating implementation of the nationwide Management and Control Plan for Bighead, Black, Grass, and Silver Carp in the United States (Plan), which was approved by the Aquatic Nuisance Species Task Force in 2007. The four species addressed by the Plan present a serious threat to North American ecosystems, including the Great Lakes, if self-sustaining populations become established elsewhere in the wild. A subset of the 133 priority management actions contained within the Plan specifically addresses the challenge of protecting the Great Lakes basin from the establishment and impacts of Asian carp.

This Framework recognizes potential hurdles to accomplishing many of the actions. Nevertheless, this Framework establishes a baseline condition for collaboration among stakeholder agencies and the interested communities from which a compelling plan of action can be launched. While preventing the establishment of a self-sustaining Asian carp population requires an understanding of ecological, economic and hydrological complexities, one conclusion is clear: a comprehensive approach is needed to reduce the risk of Asian carp invasion.

1.0 INTRODUCTION

The Great Lakes food web has been significantly degraded in recent decades and years by AIS. The migration of four species of carp not native to the United States (bighead, black, grass, and silver), also known as Asian carp, into and through the Illinois and Des Plaines River and CAWS is the most recent and possibly most acute AIS threat facing the Great Lakes today.

This report has been prepared by the Regional Coordination Committee's participating agencies to outline the Asian Carp Control Strategy Framework (Framework) that will be implemented to control impacts from the Asian carp migration.

This section briefly presents the problem of the Asian carp migration toward the Great Lakes ecosystem, reviews the multi-faceted purpose of the Framework, identifies the many agencies and stakeholders that may play a role in the Framework, and presents additional work being completed outside of this Framework. Section 2.0 introduces the Control Strategy Framework Matrix (Table 1), which presents the proposed actions and gives brief narrative summaries of the actions and action items. The actions are divided into three categories: Invasion Control (IC), Monitoring and Rapid Response (MRR), Communication and Outreach (CO), and/or a combination of the three. Section 3.0 describes the Communication and Outreach actions likely to supplement the Framework by involving the public and additional stakeholders outside the immediate circle of participating agencies. The coordination structure of the Framework Workgroup is presented in Section 4.0.

1.1 PURPOSE

The Framework is a dynamic document, reflecting an ever-increasing body of knowledge gathered from ongoing research and monitoring, as well as the December 2009 deployment of federal, state, local, and Canadian resources to conduct an eradication effort in the Chicago Sanitary and Ship Canal (CSSC). Many actions described in this Framework, such as research and feasibility studies, are expected to provide additional data that may be included in future Framework updates. However, the main objectives of this initial Framework are:

- Establish the need for participating agencies to act urgently to apply full authorities, capabilities, and resources in order to prevent Asian carp from becoming established in the Great Lakes. While scientific opinion is not unanimous that Asian carp will devastate the ecology of the Great Lakes, and not all studies have concluded that Asian carp would cause substantial ecosystem degradation, the participating agencies agree that we cannot wait for perfect certainty and must act preemptively with comprehensive measures to prevent carp from becoming established in the Great Lakes or their tributaries. Experience has shown that controlling populations of AIS, once established in the Great Lakes, is far more expensive and difficult than preventing their entry to the Great Lakes in the first place.
- To integrate and unify the impending actions of participating agencies. While agencies have coordinated significantly in the past, this Framework is a comprehensive, integrated approach to address the Asian carp threat to the Great Lakes, and helps to further to unify the participating agencies by:
 1. Describing actions to prevent carp migration.
 2. Identifying lead agencies.
 3. Establishing funding options for the actions.
 4. Determining the most effective plan for implementing the actions.

- To transition from a single point defense to a multi-tiered approach. The electric barriers remain the most important defense mechanism against Asian carp expansion. However, success in defeating Asian carp depends on the ability to transition from this single technology, located at one geographic point, to a multi-tiered defense encompassing all aspects of monitoring, surveillance, structural solutions, biological controls, and eradication response options.
- To provide direction while recognizing that the history of Asian carp migration demands a degree of flexibility by participating agencies. This Framework signals the intent and direction of participating agencies. It should not serve to limit them if adjustments in plans are needed to better serve the goal of preventing carp migration to the Great Lakes. As such, this is meant to be a living document subject to change as the situation dictates.
- To identify technical and regulatory hurdles that might complicate Framework implementation. This analysis would also improve future efforts to prevent AIS from migrating through other artificially connecting waterways of the Great Lakes watershed.
- To identify opportunities for existing stakeholder agencies to actively engage additional stakeholders' cooperation. The Great Lakes region has a proud and vibrant history of cooperation, as evidenced by the *Great Lakes Regional Collaboration Strategy*, *Great Lakes Restoration Initiative Action Plan*, and the multi-jurisdictional contributions to the December 2009 effort to prevent Asian carp from penetrating the USACE electric barriers. Cooperation is crucial to keep Asian carp out of the Great Lakes. Aggressive outreach at key milestones in this Framework's development process will result in (1) innovative and effective ideas, (2) more solid stakeholder commitments, and (3) a better chance at lowering the risk of invasion.

Additionally, the intent is that this Framework and the actions presented here will facilitate cooperation by additional agencies, not yet participating, to achieve the common goal of preventing the establishment of Asian carp in the Great Lakes. While Asian carp migration through CAWS may represent the most urgent need to control AIS through an artificially connecting waterway, it certainly is not the only need. Several artificially-connecting waterways in the states such as Michigan, Wisconsin, New York and Ohio may present conduits through which AIS are threatening or may threaten the Great Lakes. Exhibit 2 below highlights these connections, while Exhibit 3 presents the annual water flow through selected connections. While prioritizing an assessment of CAWS, the USACE Inter-basin Transfer Feasibility Study (see 2.1.6, below) will analyze these waterways as potential AIS vectors. As such, another purpose of this Framework is to provide an analog for some of the control measures that may be helpful for controlling AIS at these locations.

Exhibit 2. Artificial Connections to the Great Lakes

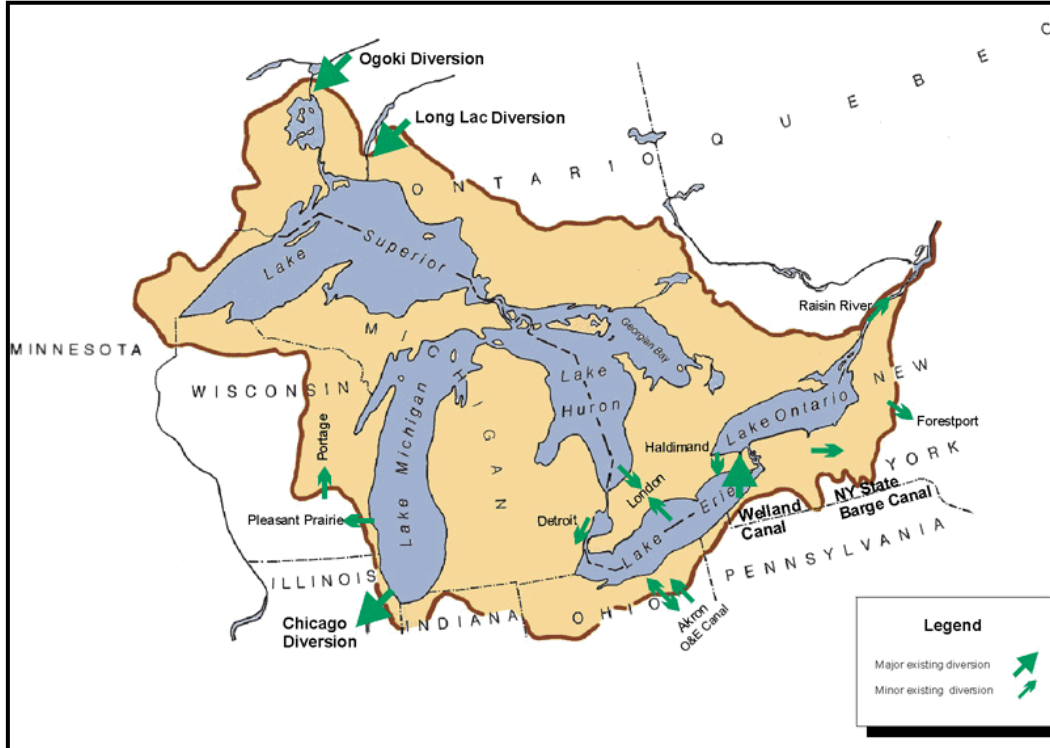


Exhibit 3. Annual Flow through Existing Great Lakes Diversions

Existing Diversions in the Great Lakes Basin	Operational Date (original project)	Average Annual Flow	
		(cms)	(cfs)
1. Interbasin			
Long Lake (into Lake Superior basin)	1939	45	1,590
Ogoki (into Lake Superior basin)	1943	113	3,990
Chicago (out of Lake Michigan basin)	(1848)1900	91	3,200
Forestport (out of Lake Ontario basin)	1825	1.4	50
Portage Canal (into Lake Michigan basin)	1860	1	40
Ohio & Erie Canal (into Lake Erie basin)	1847	0.3	12
Pleasant Prairie (out of Lake Michigan basin)	1990	0.1	5
Akron (out of and into Lake Erie basin)	1998	0.01	0.5
2. Intrabasin			
Welland Canal	(1829)1932	260	9,200
NY State Barge Canal (Erie Canal)	(1825)1918	20	700
Detroit	1975	4	145
London	1967	3	110
Raisin River	1968	0.7	25
Haldimand	1997	0.1	2

1.2 PROBLEM STATEMENT

The potential invasion of Asian carp into the CAWS and the Great Lakes has numerous ecological and economic impacts which have been recognized and extensively studied. The first excerpt is from the Asian Carp Rapid Response Workgroup Rapid Response Plan (RRP) completed and implemented in December 2009. The RRP details the emergency actions taken to prevent Asian carp migration into Lake Michigan during routine maintenance on the USACE operated electric barrier that deters Asian carp passage through the CSSC. The excerpts provide a brief background of invasive species in the Great Lakes and inland waterways, explain the main ecological impacts from the Asian carp, and list other supporting information regarding the concern of Asian carp expansion.

Background

The introduction of aquatic invasive species (AIS) into the Great Lakes and inland waterways throughout the United States is occurring at an alarming rate. Since the beginning of 19th century, over 180 species of AIS have made their way into the Great Lakes region. These fish, macrophytes, invertebrates, viruses, bacteria, and parasites can devastate native populations, as well as cause great economic damage to the Great Lakes commercial, sport, and tribal fisheries collectively valued at more than \$7B annually (Barnhart 2005). Of critical concern currently are Asian carp, a term used to describe a group of exotic fish originating in eastern Asia, that are expanding their range north through the Mississippi River basin towards the Great Lakes. Historically, successful control of AIS has resulted from focusing on small water bodies or critical control points in a system. The CSSC, which links the Great Lakes with the Mississippi River basin, is one such critical control point.

Historically, poor water quality in Chicago's urban waterways had controlled the transfer of invasive species between the Great Lakes and Mississippi River watersheds. Over the last three decades, newly created legislation and regulations aimed at improving water quality, combined with government projects focused on habitat restoration, have considerably improved water quality, resulting in an increased abundance of aquatic life in Chicago's waterways (Friends of the Chicago River 2006). The artificially connecting waterways in Chicago now form pathways for invasive species to expand their distribution between the Great Lakes and the Mississippi River System.

Asian carp are members of the family Cyprinidae. The three species identified for action under this plan for rapid response are the silver carp, bighead carp, and black carp. These fish were originally imported, along with grass carp, to southern United States aquaculture and wastewater treatment facilities to keep retention ponds clean and to serve the food fish industry. There are many potential ways by which Asian carp may have escaped. The prevailing theory is flooding which allowed for overland flow into the Mississippi River basin. The bighead and silver species of carp are expanding their range north toward the Great Lakes. During 2002 monitoring efforts, Asian carp were detected in the upper Illinois River, just 60 miles from Lake Michigan (Conlin 2002), and in 2009, a Bighead carp was retrieved considerably closer, within the Lockport Pool of the CSSC. Exhibit 1 below highlights the area of focus, the electric barriers in relationship to Lake Michigan, specific entry points into Lake Michigan, and recent locations where Asian carp eDNA was present in the water.

Bighead carp can grow to very large sizes of over 5 feet in length and 100 pounds or more. These filter-feeding fishes have "gill rakers," which are specially adapted for filter feeding plankton, one of the bases of the food chain, and are capable of consuming up to 20% of their own body weight in food each day. In the wild their eating habits allow them to quickly out-compete both small and large native fish such as the paddlefish, gizzard shad, perch, and buffalo fish. Sexual maturity is reached between 2-7 years dependent on the climate of the region (U.S. Geological Survey [USGS] 2005). Upon reaching sexual maturity, they begin spawning anytime between April and September, and can spawn multiple times during each season for the remainder of their lives. These fish live up to 20 years.

Silver carp are generally smaller than bighead carp. These highly prolific fish are similar to bighead carp in their feeding and spawning habits. Silver carp are often referred to as “flying fish” and pose a great danger to boaters, anglers, and other recreational users—of great concern on the Great Lakes. These fish are disturbed by boat motors and will jump from the water when startled. A motor boat traveling at high speeds causes these fish to jump from the water, potentially causing damage to boats and serious injuries to humans onboard.

Black carp differ from bighead and silver carp in both diet and appearance. They have large distinctive scales that are darker in color than those of the grass carp. Their pharyngeal teeth are large, resemble human molars, and are specially adapted for crushing mollusk shells. The largest black carp on record in its native China is over 7 feet long and 150 pounds. Black carp were originally introduced in the United States accidentally in shipments of grass carp. The diet of the black carp, though different from the bighead and silver carp, makes them an equally deadly threat to the waters of the Great Lakes. Black carp consume mollusks and snails; adults can consume an average of 3 to 4 pounds of mussels per day. A single black carp could eat more than 10 tons of mollusks during its life. Black carp could aid in the reduction of invasive zebra and quagga mussel populations throughout the Great Lakes; however, native mussel populations (some of which are already known to be threatened or endangered) would also be negatively impacted. The USGS has two documented reports of black carp in Illinois. The first specimen was caught in Horseshoe Lake, the second along the Mississippi River at Lock and Dam 24 in Calhoun County in 2004. Though not as widely distributed as the silver and bighead species, black carp remain a threat because juveniles are not readily distinguished from grass carp, which are sold and distributed throughout the United States and may be released into open waters (Nico 2007).

Ecological and Economic Impacts to the Great Lakes

The Great Lakes cover over 94,000 square miles and is source of an at least \$7B annual sport fishing industry. Following introduction of Asian carp into the Great Lakes basin, controlling their spread throughout these areas would be nearly impossible. Establishment of Asian carp in the Great Lakes would have lasting and potentially negative effects. Under the conditions found in the Great Lakes such as water temperature, food abundance, slow moving wetland regions, expansive area for migration, and lack of natural predators of the Asian carp, the Asian carp populations could expand very quickly. These species could significantly impact local ecosystems.

The Great Lakes are home to many important species of food and sport fish such as whitefish, bloater chubs, yellow perch, and rainbow smelt, as well as sport fish including trout, salmon, and walleye. The potential impact of Asian carp on the Great Lake's sport and commercial fishing industry can be seen now along the Mississippi River basin—where in just a few short years following introduction of Asian carp into an area, many commercial fishing locations have been abandoned, as native fish have nearly disappeared from the catch, replaced by Asian carp. The presence of Asian carp is a concern because they are prolific, grow and mature quickly, and feed on plant and animal plankton. They may alter energy flow in a semi-oligotrophic system such as the Great Lakes, which in turn could lead to undesirable consequences for sport and commercial fisheries. A 2002 workshop convened by the Great Lakes Protection Fund as well as the 2003 Aquatic Invasive Species Summit convened by Chicago Mayor Richard Daley and the U.S. Fish and Wildlife Service determined that introduction of Asian carp into the Great Lakes ecosystem would threaten the sport and commercial fisheries, and could result in ecological and economic damages exceeding those caused by the sea lamprey and zebra mussel invasion. (Chick 2002)

The Great Lakes are home to nearly 80 federally listed threatened or endangered fish, mollusks, plants, mammals, insects, and reptiles, and many more species listed as threatened or endangered at the state level. The current invaders of the Great Lakes have been implicated in adverse effects upon up to 46% of the local federally listed endangered plant and animal species. Introduction of Asian carp to the region could further harm these organisms and perhaps lead to their extirpation. One such fish of concern is the Lake Sturgeon, *Acipenser fluvescens*, which

is protected by the State of Michigan because its remaining populations are less than 1 percent of the original population due to overfishing and habitat loss. These fish age to nearly 25 years for females and 12 years for males before reaching sexual maturity, and are bottom feeders with a diet including snails, mussels, and crustaceans (Michigan Sea Grant 2009). They would be especially vulnerable to the introduction of black carp, with which they would directly compete for food. As described in the declaration submitted by the USFWS prior to the recent Supreme Court hearing, it is believed that if Asian carp populations reach self-sustaining levels at or near the confluence of the Lake Michigan tributaries and canals in the Chicago vicinity, it is highly likely that range expansion within the lake's watershed would occur over time as a result of density-dependant dispersal. As higher concentrations of fish are realized within an established area, fish will move to new areas seeking suitable habitat and resources. Through this natural dispersal process, populations of Asian carp may become established in embayments, estuaries, lagoons, and river mouths of medium to large rivers and streams proximal to the home range of an established population. These types of water bodies are found within Lake Michigan and throughout the entire Great Lakes basin.

Some studies suggest that Asian carp would have difficulty becoming established in the Great Lakes. According to a report to Illinois-Indiana Sea Grant titled, "Evaluating Asian Carp Colonization Potential and Impact in the Great Lakes:

It is not clear that Asian carp could grow feeding on the relatively sparse plankton typical of most of the Great Lakes. Filter-feeding carp are usually found in more productive waters with higher plankton abundances. Using a combination of laboratory experiments and modeling, we conclude that filter-feeding Asian carp will be unable to colonize most open water regions within the Great Lakes because of limited amount of food (plankton) available there. Productive embayments and wetlands are more likely to support Asian carp growth, and we suggest that resource managers focus monitoring and preventative efforts in these more limited areas of the Great Lakes.

While the results of various scientific studies suggest a varied range of impacts from Asian carp infestation, we cannot wait to act. State, local, and federal agencies are acting to taking pre-emptive actions to deny carp from establishing a population in the Great Lakes or their tributaries.

Evaluating Lock Closure

An often discussed solution to preventing Asian from entering the Great Lakes is closure of locks and sluice gates in the CAWS. The locks and structures in the CAWS connect the world's two largest freshwater basins, and serve as the sole or primary water connection and route by which many goods travel downstream for dissemination to the central U.S.

Description of Locks and their Function

The O'Brien Lock has a single chamber of 110' X 1000' with a six barge capacity. This lock, on the Calumet River, currently operates in a "show and go" pattern, which means that vessels are locked through when they arrive.

Much of the Chicago region's petroleum, coal, road salt, cement, and iron travel through this lock; approximately 14.6 million tons of these and other commodities transit through the Calumet River System and Harbor (includes the Cal-Sag Channel and reach above Lockport Lock) each year at a value in excess of \$2 billion. In addition, over 15,000 recreational vessels traverse this lock. The lock is also used to control the water flow between the lake and river and is both a piece of the overall flood control plan and the local water treatment process to comply with regulatory requirements. Finally, the lock is used by the Coast Guard as well as the City of Chicago for emergency uses.

Chicago Lock, the nation's second busiest, has a single chamber of 80' X 600' with a 22.4 foot depth. Constructed in 1938 in order to regulate the diversion of water from Lake Michigan, this lock has a 1 to 4 foot lift connecting Lake Michigan to the Chicago River. MWRD constructed the lock and transferred it to USACE in 1984. The lock is operated by gravity through partially opened lock sector gates and operates 24 hours a day, 7 days a week, year round.

The lock has over 11,500 annual lockages composed of over 50,000 commercial and recreational boat and 900,000 passengers. Commodities handled include general cargo, petroleum, newsprint, road salt, and cement. The harbor is a safe refuge on southern Lake Michigan for barges and vessels traveling north from or south to the Port of Chicago. The Lock itself provides flood protection on the Chicago River for the downtown area protecting over \$1B in real estate.

Authorities

Various agencies have authorities over the involved waterways and projects. USACE has direct authority over O'Brien Lock and the navigation channel through various Congressional acts for navigation (commercial and recreational) and flood control. The Chicago Lock is authorized under the Rivers and Harbors Acts of 1870, 1880, 1912, 1919 and 1962. The Federal channel is authorized to be maintained at 21 feet between the Chicago Lock, into the Chicago River and north to the North Avenue Turning Basin. USACE has the authority to undertake emergency operational measures based on Section 126 of the FY 10 Energy and Water Appropriations Act subject to approval by the Assistant Secretary of the Army for Civil Works. Section 126 may be used to close locks during certain periods upon a justification that doing so will serve to eliminate or reduce Asian carp migration.

The Coast Guard has the responsibility for transportation and safety in these same bodies of waters. The Coast Guard enforces various laws and regulations about what can pass through the lock, how the lock is to be closed to shippers even for a short time, and actions USACE can take in the water that may affect the public. For example, the Coast Guard has propagated safety rules in cooperation with USACE so that it may operate the electric barriers effectively while human activity in the area, especially navigation, can continue with minimal risk. MWRD is charged with meeting certain regulatory discharges from the city and, through section 402 permits, uses the water released from the lock to meet its discharge criteria.

MWRD has flood control, water quality, social and commercial authorities tied to these waterways.

Effect of Lock Operations on carp mitigation

Locks may serve as a barrier to impede carp migration through the Chicago and Calumet Rivers into Lake Michigan, but by themselves they are not completely effective for this purpose. When the O'Brien and Chicago Locks are closed, they do not completely stop water flow. As with most locks, there is leakage around and through the gates. Because Lake Michigan and the Chicago River are very close in elevation, O'Brien Lock is designed to control water flow, not accommodate a change in water elevation. That means it is possible for fish to swim through the lock into the lake even when the locks are "closed."

If USACE were to close the locks and take measures to make the lock more water tight, there are other ways that fish can get into the lake such as the unregulated access point through the Grand Calumet and Little Calumet Rivers in Indiana. Other access includes leaking sluice gates at both federal and non-federal facilities, release of live adult fish into the Great Lakes, the transfer of juveniles in bait buckets, or the replenishment of ballast water in marine vessels.

In major flood events in central Chicago, the Chicago and O'Brien locks and their associated controlling works serve to prevent or minimize flood damage by allowing water to flow in reverse into Lake Michigan. In the event of future flooding, USACE is considering installing grates in the bulkhead slots in locks and sluice gates to block the potential migration of any Asian carp that may be present, while allowing water levels to

subside. If the structures were permanently closed, in flooding situations, lock and sluice gates would likely not contain Asian carp, as floodwaters carrying fish in the overflow could overtop the structures and flow unrestricted to Lake Michigan. Modified structural operations discussed in this Framework and being considered under the Efficacy Study, may be able to limit the migration of Asian Carp during flooding or operation of locks, dams and pumping stations.

Risks and cost associated with closure

Assessments of potential economic impacts of lock closure, whether intermittent or permanent, are still in the preliminary stages. However, all the initial information available indicates that the consequences could be serious. For example, in 2008 an estimated \$192 million in transportation savings to shippers resulted from utilization of the O'Brien and Chicago locks versus the least cost overland routing. Much of the Chicago region's oil, cement, iron, and coal travels through this lock. Without an alternate route that can accommodate the high level of traffic, key industrial building blocks of the regional economy could be damaged and exports could be delayed, face significant increases in shipping costs or, in a worst case scenario, stop the flow of critical commerce. This does not account for secondary and tertiary effects that consumers will likely face in the form of higher costs, shortages, loss of services, and loss of jobs. Indefinitely closing the Chicago Lock would also greatly affect companies that rely on the waterway for tourism.

Closing O'Brien Lock would lead to serious difficulties in delivering products in several ways. First, diverting vessel traffic from the Calumet River will deprive barges of much of the fleeting area available in the Chicago Region, increasing congestion. Currently, there are very limited fleeting areas for barges in the vicinity of Chicago Lock, the main alternative to O'Brien Lock. This would result in having as many as several hundred barges in stationary positions for indefinite periods of time while waiting to be loaded or unloaded, a major safety concern.

Accessing Calumet Harbor via the Chicago Lock is not a matter of choosing a different route. Arriving at Calumet Harbor without going through O'Brien Lock would require transit through Lake Michigan. Existing regulations preclude carrying liquids such as petroleum products. In addition, the use of Calumet Harbor would require the barges to clear low railroad bridges, which would require ballasting and de-ballasting, which could add \$500 to \$1,000 per barge transit, a cost that is likely to be prohibitive to barge operators and their customers.

According to the MWRD, which serves as the wastewater and stormwater management agency for Chicago and 124 municipalities across the region, permanent closure of lock and sluice gates along the CAWS, without additional deep tunnel or reservoir capacity, would likely result in devastating flooding throughout the region.

Impacts to the economy such as jobs and businesses, the environment, and other modes of transportation amongst other issues will be evaluated in the environmental review process as part of the USACE Inter-Basin Feasibility Study, expedited to 2012 for the CAWS.

Decision Making Process and Timeline

A study is underway to assess the concept of "modified structural operations." Alternatives are under consideration to modify lock operations from constant availability for vessel lockage to scheduled intermittent periods of operation for transit. Periods of non-operation would be synchronized with efforts by other agencies to take steps to suppress, eliminate, or reduce Asian carp populations that may be present in a target area of action. This concept envisions controlling the periods during which navigation traffic could pass through the locks, so that effective measures to attack Asian carp populations that may be present in the waterway could be taken. Modified lock operations would not impact emergency operation of O'Brien or Chicago Locks for flooding or public health & safety. It is anticipated an interim III report to the Efficacy

Study would be submitted in early March to address modified structural operations. This concept, if it is found to be feasible, would continue to evolve and be improved over the next few months and into warmer weather, in combination with fish suppression activities such as Rotenone, electro shocking & netting, and fish diversion technologies, such as bubble and acoustic barriers. Structural modification to locks such as installation of screens is also under consideration.

While Section 126 emergency authority does allow USACE to temporarily close the locks, inadequate information is available at this time to be able to make a decision regarding indefinite or extended temporary (several weeks or more) lock closure. The impacts of such an action to the environment (sewer overflow could back up into Lake Michigan), from flooding, to public health and safety and marine emergency uses, and to the economic activity of the greater Chicago area (such as transportation of critical commodities, recreational traffic, harbor owners and operators, commercial and sport fisheries, and neighboring businesses) connected to the Chicago and O'Brien locks, need to be assessed against the expected impact to the Great Lakes recreation and fisheries industries based on scientific research to develop data on the expected manner and extent to which Asian Carp are likely to affect the Great Lakes.

1.3 PARTICIPATING AGENCIES – ROLES/AUTHORITIES/JURISDICTIONS

This section generally describes the jurisdictions, authorities, and roles of the agencies and governmental units participating in this Framework. This is meant to be an informal description of these agencies with respect to the actions discussed in this Framework, and is not meant to restrict or assign responsibilities and authorities belonging to the agencies under their implementing statutes and regulations.

- **City of Chicago**

Jurisdiction: Exercises home rule authority within municipal limits

Authority: Municipal

Role: Supports the work of other agencies, particularly those actions taking place within the City of Chicago, and performs law enforcement, patrol, and emergency response duties along the lakefront and inland waterways within the City's jurisdiction.

- **Great Lakes Fishery Commission**

Jurisdiction: Great Lakes Fishery Convention Act allowing implementation of a convention of Great Lakes Fisheries between Canada and the United States

Authority: Bi-lateral treaty

Role: Coordinate, communicate, and conduct fishery resources on the Great Lakes

- **Illinois Department of Natural Resources (IL DNR)**

Jurisdiction: Investigations pertaining to the natural history, entomology, zoology, and botany of the State; the geology and natural resources of the State; the water and atmospheric resources of the State; and the archeological and cultural history of the State of Illinois.

Authority: State

Role: Lead agency for work relating to monitoring, sampling, fish removal actions, and rapid response activities within the State.

- **Metropolitan Water Reclamation District of Greater Chicago (MWRD)**

Jurisdiction: Surface water, municipal wastewater treatment for the metropolitan Chicago area (including almost all of Cook County), control of combined sewer overflow, dry and wet weather operation of the Chicago Area Waterways.

Authority: Regional

Role: Supports the work of other agencies and implements designated action items to the extent allowed by its statutory wastewater and stormwater authority.

- **United States Army Corps of Engineers (USACE)**

Jurisdiction: Planning, construction and operation of navigation and flood damage reduction projects; recovery of structures throughout the Great Lakes Basin; hydropower operations, environmental protection and restoration, water conservation, recreation, and disaster assistance

Authority: Federal

Role: Operation of the CAWS Lock and Dam System and the Electric Dispersal Barrier
- **United States Coast Guard (USCG)**

Jurisdiction: Navigable waterways.

Authority: Federal Authority; Port and Waterways Safety Act of 1972 and 14 U.S.C. § 89 among others

Role: Ensure the safety, security and environmental protection of the Great Lakes and the Western Rivers. The Coast Guard manages waterways through Regulated Navigation Areas, safety and security zones. Regulates the marine industry and supports the marine transportation system
- **United States Environmental Protection Agency (USEPA)**

Jurisdiction: Lead coordination agency.

Authority: Federal Great Lakes protection and restoration policy and efforts under CWA 118 and Executive Order 13340.

Role: Lead coordination agency and funding authority.
- **United States Fish and Wildlife Service (FWS)**

Jurisdiction: Implementation of activities in support and enforcement of the Lacey Act, Endangered Species Act, Fish and Wildlife Coordination Act, Great Lakes Fish and Wildlife Restoration Act, and the Non-indigenous Aquatic Nuisance Prevention and Control Act as amended; and supporting activities to include fish and AIS monitoring, risk assessment, law enforcement, etc.

Authority: Federal

Role: Coordination with Federal, State, Tribal, and non-governmental partners on actions to prevent the introduction and establishment of aquatic invasive species, or to mitigate resource impacts from introduce species
- **United States Geological Survey (USGS)**

Jurisdiction: NA

Authority: Federal

Role: Provide leadership and technical expertise in collaborating efforts to prevent and mitigate the risk of introduction and establishment of ANS or AIS
- **White House Council on Environmental Quality**

Jurisdiction: NA

Authority: Federal - CEQ coordinates Federal environmental efforts and works closely with agencies and other White House offices in the development of environmental policies and initiatives.

Role: CEQ is closely monitoring the development and execution of the Asian Carp Control Strategy Framework.

1.4 ADDITIONAL ASIAN CARP WORK

In addition to the actions proposed within this framework, the U.S. Fish and Wildlife Service's (FWS) Midwest Region is currently coordinating implementation of the Management and Control Plan for Bighead, Black, Grass, and Silver Carp in the United States (Plan), which was approved by the Aquatic Nuisance Species Task Force in 2007. The four species addressed by the Plan present a serious threat to North American ecosystems, including the Great Lakes, if self-sustaining populations become established in the wild. A subset of the 133 priority management actions contained within the Plan specifically addresses the challenge of protecting the Great Lakes basin from the establishment and impacts of Asian carp. As lessons are learned through implementation of this plan elsewhere in the region and throughout the nation, applicable solutions will be adopted for the Great Lakes.

The Plan contains specific actions to prevent Asian carp from entering the Great Lakes; or to contain, control, and mitigate impacts in the event of their access into the basin. The strategy uses a multi-tiered, "integrated management" approach based on timely data and current or emerging tactics and tools. Actions include the following:

- Develop and refine effective methods for sampling populations of Asian carp, and for predicting abundance and distribution (as a risk assessment and risk management decision support tool).
- Constrain Asian carp range expansion/population growth via development and deployment of physical and behavioral barriers to fish movement at critical geographic locations (including sonic, bubble, light, velocity, and chemical barriers).
- Control (remove Asian carp) through:
 1. Strategic and intensive "recruitment overfishing"
 2. Development and application of chemical control tools and piscicide delivery systems to control bighead and silver carp in an effective, efficient, and work with partners to develop and implement a coordinated Asian carp public outreach and education campaign focused on preventing movement of fish.

2.0 UNIFIED ACTIONS FOR PREVENTING ASIAN CARP MIGRATION

Table 1 provides the Control Strategy Matrix (Matrix) of the many aspects of the actions proposed in this Framework to prevent migration of the Asian carp to the Great Lakes. The narratives below are descriptive highlights of the actions outlined in more detail in the Matrix. The actions have been divided into short and long-term implementation goals. Short-term is defined by actions that can be implemented between February and May 15, 2010; the remaining actions are considered long-term goals. Each action was further divided into three subcategories that, either alone or in combination, roughly correspond to the efforts by each workgroup: (1) Invasion Control (IC), (2) Monitoring and Rapid Response (MRR), or (3) Communication and Outreach (CO).

For the most part, the narratives were developed by the lead agencies for each action and were reviewed by the participating agencies.

The "Action" column in the Matrix identifies efforts that are, will or can be undertaken by participating agencies.

The "Agency" column in the Matrix identifies in bold the agency(ies) responsible for the action narratives below and for acting as the lead agency in implementing the action. In some cases, more than one lead agency has been designated. Agencies not identified in bold will support the lead agencies in implementing the action.

The Funding, Funding Source, Start Date, and Planned Completion columns generally represent estimates by the lead agency and may change as the actions are undertaken and funding is secured. The "Comments" column may provide qualifiers or other pertinent information about the above.

2.1 SHORT-TERM ACTIONS / ACTION OPTIONS

While a number of actions are needed to control carp in the long-run, there is urgent need to limit the possibility of carp imminently infiltrating Lake Michigan. As such, the following actions are needed between February and April, 2010:

- Operations to reduce propagule pressure
- Increased fish collection effort for confirmation of eDNA results and population suppression
- eDNA indicator refinement
- Modified structural operations
- Emergency measures to create ecological separation between (1) Des Plaines River and CSSC and (2) I&M Canal and CSSC
- Increased biological control efforts
- Barrier operations

Specific proposed actions in support of these short-term actions include the following:

2.1.1 Targeted Removal within Chicago Area Waterway System (CAWS)

Workgroup: MRR

Lead Agency: Rapid Response Team (IL DNR, USFWS, USACE, USCG, etc.)

Estimated Funding: \$2,000,000

Funding Source: Great Lakes Restoration Initiative (GLRI) monies

Problem: Asian carp eDNA has been detected upstream of the barrier in several locations. Although no fish have been collected or seen on the lakeside of the barrier, the presence of eDNA strongly suggests that fish may be present. In addition to random and systematic sampling throughout the system to detect Asian carp, future sampling should also have a strategic and intensive component designed to seek and destroy/capture Asian carp above the barrier.

Action: This action will include eDNA sampling in likely locations with rapid analysis of samples. Depending on the season, likely locations will include areas adjacent to warmwater discharges, wastewater treatment plant outfalls, tailwaters of locks and dams, marina basins, barge slips, and other slackwater areas. If positive hits are encountered, the intent would be to concentrate and confine individuals into an area where they would be susceptible to removal through toxicants or nets. Fish would be driven with electrofishing gear and/or light/sound systems against lock and dam structures or into basins and inlets where they could be confined with block nets and removed with rotenone. Commercial fishermen would also be deployed to set block nets and trap fish within short segments of the waterway where they could then be driven into gill and trammel nets or removed with rotenone. This effort will be conducted beginning in February and continuing through November or until no further evidence of Asian carp is seen. This project could deploy up to 15 conventional electrofishing boats and state/federal fisheries crews as well as multiple commercial fishing companies. Costs also include rotenone and the detoxifying agent sodium permanganate, substantial fishing gear of multiple types, and additional electrofishing rigs and crews beyond those already available to state and federal agencies. Field work would be conducted by IDNR, USFWS, USACE, and other state agencies who agree to participate.

Expected Milestones:

- 2nd quarter 2010 – initiation of field work

Potential Hurdles:

- Weather conditions.
- Field crew availability.

2.1.2 Enhanced eDNA Testing, Contract Commercial Fishing, and Conventional Monitoring in “High Risk” Locations

Workgroup: MRR

Lead Agency: IL DNR, USFWS, USACE

Estimated Funding: \$2,600,000

Funding Source: USACE, USFWS, IL DNR GLRI monies

Problem: Capture and/or direct observation provides the most solid confirmation of the presence of Asian carp; however efforts to the present have been limited and unable to yield results. Enhanced monitoring via traditional and new approaches must be ramped up in an effort to yield Asian carp and to verify eDNA results.

Action: Increased eDNA capacity, commercial fishing, and conventional monitoring will target selected locations adjacent to and above the electrical barriers, including the Cal-Sag Channel near O'Brien Lock and Dam, the North Shore Channel near the Wilmette Pumping Station, and Lake Michigan. Multiple agencies have and will continue to participate in and fund the monitoring efforts. FWS, IDNR, and the Illinois Natural History Survey will deploy dedicated field crews to conduct Asian carp monitoring in specified locations within the CSSC, Cal-Sag Channel, Chicago River, North-Shore Channel, portions of the Des Plaines River, and selected near-shore areas of southern Lake Michigan in the vicinity of metropolitan Chicago (areas adjacent to industrial/municipal water and other warm-water discharges, tributaries, and near-shore embayments). Additional support will be sought from the DNR's of other Great Lakes States. Multiple boats and crews will be allocated to each target area (up to eight 6-person teams of two boats each) will sample monthly over a 1-2 week period each month. During each of these sampling periods, one or more commercial fishing crews will be deployed to work in concert with state and federal crews or to sample locations unsuitable for standard fisheries sampling gear. Monitoring will include gill and trammel netting and electro fishing at all locations, side-scan or DIDSON sonar, and/or trained observation divers, where possible. Early monitoring efforts will focus on areas that previously yielded positive eDNA results, locations sampled with sonar that demonstrate multiple large fish targets (possible Asian carp), areas with visual sightings of suspected Asian carp, or other locations determined to be "high-risk." Enhanced sampling will be used to document the extent of Asian carp population dynamics within the canal system and connecting waterways, to provide data for modeling potential population movements (range expansion), and to determine life stages of Asian carp potentially present. Monitoring activities will be conducted in cooperation with IL DNR, USACE, and other partners.

Expected Milestones:

- Early 2010 – Enhanced monitoring to begin (dependent on weather conditions)

Potential Hurdles:

- Weather conditions.
- Staffing concerns which include hiring additional employees for both field and lab work.

2.1.3 eDNA Calibration Methodology and Increased Capacity

Workgroup: MRR

Lead Agency: USACE, IL DNR, FWS

Estimated Funding: \$940,000

Funding Source: USEPA and USACE GLRI monies



Problem: eDNA analysis is an emerging and cutting edge science for predicting the presence and tracking the movement of Asian carp through a waterway. To further validate its use as an effective tool, its methodology must be further refined and its analysis capacity increased.

Action: eDNA sampling and processing will be a joint effort of the University of Notre Dame and the research laboratory of USACE, as directed by USACE, in collaboration with the FWS and IL DNR. eDNA capacity is being increased with the addition of sampling and processing capability at USACE research laboratory in cooperation with the University of Notre Dame. eDNA validation efforts are underway. Field tests are being conducted in conjunction with Rotenone application, electro fishing and netting, and commercial fishing. Future eDNA sampling will be synchronized with conventional monitoring and possible

response actions in specific geographic areas, in a collaborative effort among the primary agencies engaged in monitoring and response activities.

Expected Milestones:

- February 2010 – EPA completes laboratory quality control analysis and submits final report.
- April 2010 – Laboratory testing to confirm eDNA accuracy in detecting Asian carp
- April 2010 – Initiation of new synchronized sampling program.
- Summer 2010 – Comprehensive field experiments to consider effectiveness of eDNA analysis in determining both presence and estimated population abundance.

Potential Hurdles: None

2.1.4 Modified Structural Operations - Efficacy Study - Interim Report III

Workgroup: IC

Lead Agency: USACE, USCG, MWRD, FWS, IL DNR, Chicago

Estimated Funding: NA

Funding Source: USACE Appropriation

Problem: Modified lock and attendant works (sluice gates and pumping stations) operations could impede the opportunity for Asian carp to enter the Lake Michigan. All potential impacts must be considered to ensure public health and safety, and the purposes of these structures are maintained as authorized in law.

Action: As part of the effort to address the threat that Asian carp pose to the Great Lakes, USACE intends to assess the potential use of "modified structural operations" on the CAWS, in collaboration with agencies that use the CAWS. "Modified structural operations" are defined as operating the locks and attendant works of the CAWS such as sluice gates and pumping stations to impede Asian carp migration into the Great Lakes consistent with public health and safety and maintenance of navigation. The potential impacts of controlled operations, as well as the specific parameters of such operations, would be assessed and understood under any applicable laws such as the National Environmental Policy Act prior to deciding to proceed with implementation. Modified operations would be executed through a comprehensive plan, broad collaborative participation and use of resources, integrated continuous management and decision-making, and documented procedures agreed to by relevant agencies and effectively communicated to CAWS users.

Four general goals for modified structural operations:

- To ensure, to the fullest extent possible, that no Asian carp migrate into Lake Michigan
- To preserve emergency use of the CAWS, locks and structures, as well as other uses essential to public health and safety
- To maintain navigation through the locks
- To modify operations and cooperate with vessel users as CAWS structures are changed.

Three phased approach

- Phase 1: Concept Development - Integrate agencies' efforts to develop methods to suppress Asian carp population growth while USACE and USCG simultaneously determine, after engaging the navigation industry, how to optimize/reduce the number of lock openings, and MWRD considers how to operate the Wilmette Pumping Station, to impede Asian carp movement. The

goal for this phase is to complete concept development and recommend actions by early March 2010.

- Phase 2: Initial Implementation – Execute modified structural operations as quickly as possible once methodologies are ready, with most elements underway by April 30, 2010. Some methodologies currently under consideration include:
 - Closing both sets of lock gates between lockages
 - Reducing the frequency of lock openings by consolidating barge and recreation traffic
 - Four scenarios are being assessed, as follows:
 - Alternative 1 – No action; Chicago and O’Brian Locks operate as normal
 - Alternative 2 – Modified Structural Operations – Close each week; Chicago and O’Brian Locks open 3-4 days every week, a significant reduction from current “show and go” operations. Checking potential to place screens on the sluice gates and the lock gates during periods of closure.
 - Alternative 3 – Modified Structural Operations – Close one week / month; Chicago and O’Brian Locks closed to navigation one week per month starting in April 2010.
 - Alternative 4 – Modified Structural Operations – Close every other week; Chicago and O’Brian Locks closed to navigation two weeks per month starting in April 2010.
 - Applying technologies to “herd” and reduce Asian carp populations that may be present, to include rotenone
 - Intensified and synchronized monitoring (eDNA, electro fishing, and netting).
- Phase 3: Additional Implementation – adjust initial methodologies based on field results for longer sustainable operations. Continue to field new workable and appropriate methodologies as they become available such as acoustic and electric barriers, as well as addition of screens to sluice gates and bulkheads

Expected Milestones:

- Early March, 2010 – Complete concept development and recommend actions
- April 30, 2010 – Implement methodologies as ready for modified lock/structure operations
- End: FY 2010 – Full implementation

Potential Hurdles:

- Development and implementation of controlled operations plan under a compressed timeline to execute by onset of warmer weather.
- Public health and safety impacts.
- Economic impacts.
- Need for rulemaking and public notice.
- Establishment of a Vessel Traffic Management System.
- Requirement of additional resources (manpower and vessels) for enforcement of waterway restrictions.

2.1.5 Des Plaines River and I&M Canal Barriers

Workgroup: IC

Lead Agency: USACE

Estimated Funding: \$13,200,000

Funding Source: USACE FY2010 GLRI monies

Problem: Physically block known bypasses around the fish barriers from the Des Plaines River and the I&M canal caused by flooding.

Action: On January 12, 2010, the Assistant Secretary of the Army for Civil Works (ASA CW) approved the interim efficacy study report recommendations addressing potential structural solutions, such as bypasses between the Des Plaines River and the CSSC, and the I&M Canal and the CSSC during high water events. The structural solutions include 13.5 miles of concrete barriers and ¼-inch chain link heavy duty fence between the Des Plaines River and the CSSC, and blockage of the Illinois and Michigan (I&M) Canal at the natural flow divide.

Expected Milestones:

- March 2010 – Scheduled contract award
- October 2010 – Construction completion

Potential Hurdles:

- Real estate acquisition/easements.

2.1.6 Technologies Using Oral Delivery Platforms for Species-Specific Control

Workgroup: MRR/IC

Lead Agency: USGS

Estimated Funding: \$1,553,000

Funding Source: USEPA FY2010 GLRI monies

Problem: The technology does not currently exist to specifically target Asian carp for control within aquatic ecosystems. Methods with high specificity for Asian carp are necessary to control or eradicate them without harm to native species and habitat.

Action: Development of a targeted oral delivery platform using novel incorporation technologies that have the capacity to deliver biocides to specific target sites in AIS may increase the selectivity and specificity of both current and potential new management chemicals. This large integrated project will focus on developing these approaches for application throughout the Great Lakes. In FY 2010, work will focus on initiating development of new integrated pest management approaches for Asian carp and other invasive aquatic species of concern to Great Lakes managers, including researching candidate bioactive agents, pathogens, and specific targeted delivery platforms.

Expected Milestones:

- 2nd quarter 2010 – Research work expected to begin dependent on available funds.

Potential Hurdles:

- Long lead time from development to field testing.

2.1.7 Expand Research on the Identification of Asian Carp Attraction/Repellent Pheromones

Workgroup: MRR/IC
Lead Agency: USGS
Estimated Funding: \$300,000/yr
Funding Source: GLRI monies

Problem: Technologies presently do not exist to specifically target Asian carp for control within aquatic ecosystems. Current applications of non-selective toxicants (e.g. Rotenone) harm native fish species and must be applied to broad expanses of aquatic habitat if they are to have effect. The lack of a species-specific method of attraction (e.g. pheromones) limits the ability to achieve maximal control while minimizing risk to native fishes. Developing attractants/repellents with high specificity for Asian carp are necessary to control or eradicate them without further harm to native species and habitat.

Action: USGS will conduct research to better define the active pheromone components and the response of Asian carp to pheromone products. Conceptual models will be developed in which pheromones could be integrated into management programs to control or limit Asian carp. Methods will be developed to synthesize active pheromone components.

Expected Milestones:

- Preliminary work done
- Utilize electrophysiology to identify the most active pheromonal substances and attractant pheromones in silver and bighead carp
- Attempt chemical synthesis of the most effective pheromonal substances

Potential Hurdles:

- Chemical tool research and development recently initiated; long lead time for field testing.
- Scale-up of pheromone production.
- Potential competition with natural hormones to prevent 100% efficacy.

2.1.8 Identify Potential Compounds for Inclusion in a Toxicant Screening Program to Identify Potential Selective Toxicants for the control of Asian Carp

Workgroup: MRR/IC
Lead Agency: USGS
Estimated Funding: \$300,000/yr
Funding Source: GLRI monies

Problem: Current toxicants used to control aquatic invasive species are general toxicants with limited to no selectivity (e.g. Antimycin, Rotenone). Agrichemical and pesticide laboratories create thousands of new chemical compounds yearly. Although toxicity information is generally not available for these new compounds in aquatic organisms, structure activity relationship analysis could identify likely candidates for inclusion in a toxicant screening program.

Action: USGS will develop cooperative research and development agreements to access pharmaceutical or agrochemical company chemical libraries to identify potential candidate toxicants. Identification of potential toxicants will either be through structure activity relationships or through known activity models. Studies will be required to assess selective toxicity of candidate toxicants between Asian carp versus native fishes. Additional data sets would be required to support registration. Efforts would be made to target those

compounds/formulations with present agrichemical/pesticide use to reduce costs and time required to obtain full registration.

Expected Milestones: Unknown

Potential Hurdles:

- Development of cooperative research and development agreements.
- New compounds will require development of full registration dossier before widespread use.

2.1.9 Evaluate Physical Methods to Disrupt Asian Carp Spawning Behavior and Decrease Egg Viability

Workgroup: MRR/IC
Lead Agency: USGS
Estimated Funding: \$200,000/yr
Funding Source: GLRI monies

Problem: Technologies presently do not exist to specifically target Asian carp for control within aquatic ecosystems. Current physical controls (e.g. electro shocking, netting) are of limited success in altering populations. The development of physical methods to disrupt Asian carp spawning activities in identified tributaries coupled with attractant/dispersal pheromones has the potential to limit Asian carp reproduction success.

Action: Research will focus on identification of sound wave amplitude and frequency which elicit silver carp avoidance behavior to disrupt spawning aggregations and limit recruitment. Research will also be conducted to evaluate the response of Asian carp eggs to electrical fields, sonication, etc. to develop methods to reduce egg viability while the eggs drift downstream of Asian carp spawning areas. The research will enable integrated approaches to prioritize locations of potential physical controls in identified spawning habitat coupled with the application of attractant/dispersal pheromones.

Expected Milestones:

- Earliest field application would be in 18 to 24 months. Field application may/may not require permit application/approval from various environmental regulatory agencies.

Potential Hurdles:

- Scaling equipment from laboratory application to field trials.

2.1.10 Identification of Organism-Level Target Delivery Sites – ‘Bio-Bullets’

Workgroup: MRR/IC
Lead Agency: USGS
Estimated Funding: \$200,000/yr
Funding Source: GLRI monies

Problem: Current toxicants used to control aquatic invasive species are non-selective and applied as immersion exposures – resulting in equal exposure of native and invasive species to the toxicant. Development of a targeted delivery system, so-called ‘bio-bullets’, which reduces non-target species exposure to the toxicant, could greatly enhance selectivity and reduce effects to non-target species. Development of such delivery methodologies will require full understanding of native and invasive species

gill and gut enzyme activity and physiology since a targeted delivery system will likely use an oral or gill adhesion delivery route.

Action: Research will be conducted to identify and characterize potential bioactive agent delivery sites within Asian carp including the gill, skin, and gastrointestinal tract (gastric or post-gastric). Research will focus on collection of data on the physiological characteristics of both Asian carp and native species (e.g., enzyme, protein, lipid, carbohydrate components, pH) to provide an understanding of factors that might affect delivery of a bioactive agent. While some basic research is available in this area, additional basic and applied research will lead to development of optimized delivery components to enhance selectivity and sensitivity. Research planned to characterize Asian carp gastrointestinal pH and digestive enzyme profiles will be expanded to include identification and characterization of native fish gastrointestinal tracts.

Expected Milestones:

- Identification and characterization of gastrointestinal pH and digestive enzyme profiles of native phytoplanktivorous and zooplanktivorous fishes

Potential Hurdles:

- Potential seasonal enzyme profiles (e.g. enzymes adjusted to match food resources) may require delivery platforms to be seasonally adjusted to match enzyme activity.

2.1.11 Great Lakes' Tributary Assessment for Asian Carp Habitat Suitability

Workgroup: MRR/IC

Lead Agency: USGS

Estimated Funding: \$275,000/yr

Funding Source: GLRI monies

Problem: Tributaries that would be suitable for bighead carp spawning need to be identified to focus management efforts for evaluating invasion success, as well as sites to launch control actions.

Action: Although bighead carps are preferentially inhabitants of lakes and slow moving waters, they are thought to require a long river for spawning and recruitment. An often-cited value in the literature is a minimum length of 100 km. Kolar et al. (2007) identifies 22 rivers on the USA boundaries of the Great Lakes that have a minimum undammed river length of 100 km, and an Asian carp risk assessment performed by the Canadian Department of Fisheries and Oceans includes an inventory of the Canadian Rivers with a minimum length of 50 km. However, the estimates of river length required are based on locations where populations of bighead carps are known to be found, and thus do not describe a true minimum. Recent research has determined the developmental stage at which bighead carp larvae are capable of swimming and migrating laterally from flowing water into nursery habitats. This knowledge can be used in a model of river velocity and temperature to describe an actual river length required. This more accurate minimum river length, taken together with the temperature and velocity regimes of individual rivers, can be used to more accurately determine which rivers are suitable for spawning and recruitment of bighead carps.

Expected Milestones:

- Determine more exact timeline for Asian carp to achieve required key developmental stages
- Determine the minimum velocities needed to keep Asian carp early, non-swimming life stages, adrift

- Determine using Doppler current profile data, the mean velocities and longitudinal particle dispersion coefficient of rivers most likely to be used as spawning habitat by Asian carp
- Model the transport of Asian carp eggs and larvae to assess spawning habitat suitability

Potential Hurdles:

- Temperature and hydrograph variability will require wide variety in models.
- The exact source of mortality in eggs and larvae that precipitate to the bottom of a river are not known.

2.1.12 Risk Assessment of Asian Carp Establishment in the Great Lakes, Based on Available Food Sources

Workgroup: MRR/IC

Lead Agency: USGS

Estimated Funding: \$250,000/yr

Funding Source: GLRI monies

Problem: Asian carps have yet to become established in open waters in the United States. However, under varying conditions Asian carp have been observed to diversify their diet beyond their preferred pelagic plankton sources and feed on detritus. Feeding studies are needed under controlled conditions where the flexibility in the carp diet can be defined thus establishing their ability to maintain large populations in the Great Lakes.

Action: USGS has observed bighead carp feeding on sediment detritus in ponds, and silver carp feeding on attached algae in aquaria. Also, silver carp are thought to derive substantial nutrition from bacteria, both consumed and cultured in the gut. However, it is not known whether these food sources are adequate for carp growth and survival. It is unknown whether they could feed adequately on planktonic resources currently found in the Great Lakes, or if they could exploit sediment detritus or attached algae (like *Cladophora*, now a substantial problem in parts of the Great Lakes because of the dreissenid mussel invasion) to a degree that would allow them to maintain large populations. USGS proposes investigating these questions using laboratory (juvenile fish) and pond (adult or sub-adult fish) mesocosm studies combined with bioenergetic techniques, to assess the risk of bighead carp establishment in the Great Lakes based on these food sources.

Expected Milestones:

- Offer non-planktonic resources such attached organic substrate on zebra mussel shells as found in the Great Lakes
- Predict if the conditions found in the Great Lakes will prove adequate for growth and survival when planktonic resources are unavailable
- Focused studies on role of bacterial consumption as potential nutrition for Asian carp.

Potential Hurdles:

- Time required for behavioral and physiological adaptations to new foods.

2.1.13 Continued Operation of Demonstration Barrier and Barrier IIA

Workgroup: IC
 Lead Agency: USACE
 Estimated Funding: \$4,750,000
 Funding Source: USACE Appropriation

Problem: The electrical barrier is the best tool we have right now to stop large-scale movement of Asian carp from the Illinois River.

Action: Barrier I (Demonstration Barrier) operates at 1 volt/inch. Barrier IIA operates at 2 volts/inch, at the pulse rate and width supported by optimal operating parameters research as preventing passage of adult and juvenile Asian carp. The maintenance cycle scheduled for October 2010 should coincide with operation of Barrier IIB so that additional treatment of the waterway will not be necessary during shutdown. Operations and necessary maintenance are funded by USACE.

Expected Milestones:

- October 2010 – required maintenance shutdown for Barrier IIA

Potential Hurdles: None

2.1.14 Expedited Construction of Barrier IIB

Workgroup: IC
 Lead Agency: USACE
 Estimated Funding: \$13,000,000
 Funding Source: USACE Appropriation

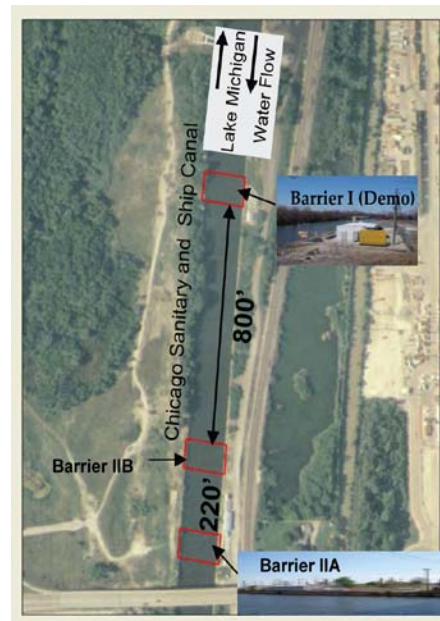
Problem: To further fortify the existing dispersal barrier with a second barrier capable of running at voltage levels high enough to repel all fish is necessary. A second barrier will ensure sustained operation during scheduled maintenance and in the event of catastrophic failure.

Action: Design of Barrier IIB electronics is ongoing, with award for supply and installation pending.

Expected Milestones:

- October 2009 – Contract for construction of Barrier IIB awarded through Recovery Act funds
- May 2010 - Award of electronics and contract
- September 2010 – Barrier IIB completed
- October 2010 – Barrier IIB fully operational

Potential Hurdles: None



2.2 LONG-TERM ACTIONS / ACTION OPTIONS

2.2.1 Final Efficacy Study Report

Workgroup: IC
Lead Agency: USACE
Estimated Funding: \$1,100,000
Funding Source: USACE Appropriation

Problem: Continued transfer of AIS between the Great Lakes and the Mississippi River Basins in spite of the Dispersal Barrier. Additional hydraulic connections between the two basins could provide transfer and need to be addressed.

Action: Evaluation of other potential emergency measures to deter the migration of the Asian carp is proceeding via the Final Efficacy Study report. Other electrical barriers, other types of behavioral barriers, and use of existing structures are being considered. In addition, this report will discuss other assisted transits (bait buckets, ballast water), and Asian carp population control, as well as provide a preliminary assessment of impacts. The efficacy study is underway with USACE funding.

Expected Milestones:

- September 2010 – Study completion

Potential Hurdles:

- Extension of Section 126 emergency authority.
- Authorization for implementation of longer term recommendation and funding.
- Waterway vessel impacts require rulemaking and public notice.
- Enforcement of waterway restrictions requires additional resources (manpower and vessels).

2.2.2 Inter-Basin Feasibility Study which will consider Lock Closure and Ecological Separation

Workgroup: IC
Lead Agency: USACE
Estimated Funding: \$1,000,000
Funding Source: USACE base funding and FY 2010 GLRI monies

Problem: Continued transfer of Aquatic Invasive Species between the Great Lakes and the Mississippi River Basins. Additional hydraulic connections between the two basins could provide transfer and need to be addressed.

Action: The Inter-basin Transfer Study is the long-term effort of USACE, in collaboration with federal, state, regional, and local agencies and non-governmental organizations (NGO), to explore all options and technologies that could be applied to reduce the risk of AIS transfer between the Great Lakes and Mississippi River basins. The study will provide a thorough identification of potential hydraulic connections between the two basins, exploration of potential invasive species, and comprehensive analysis of AIS control technologies, including but not limited to physical or ecological separation. Ecological separation is a concept would prohibits the movement or interbasin transfer of aquatic organisms by permanently separating the Mississippi and Great Lakes basins through a closure or blockage in the CSSC. This action would severely impact the flow of goods and vessels, and may have far reaching economic impacts.

The study will also evaluate the potential for extended (temporary or permanent) closure of locks and other physical structures to impede the continued migration of invasive species.

The Feasibility Study will analyze the environmental impacts and the impacts that each alternative plan would have on the current uses of the CAWS, as well as other identified hydraulic connections, including flood damage reduction, stormwater management, effluent conveyance, commercial and recreational navigation, and others identified. The initial steps will be identification of problems and opportunities and data collection to inventory existing conditions. An interim report will focus on the Asian carp and the CAWS. Authority and funding for implementation will be addressed on completion of the study.

Expected Milestones:

- 2012 – Expected completion of interim Feasibility Study and EIS on CAWS

Potential Hurdles:

- Strong collaborative participation.
- Implementation authority.

2.2.3 Modified Structural Operations

Workgroup: IC

Lead Agency: USACE

Estimated Funding: NA

Funding Source: No funding necessary

Problem: Hydraulic connections between the Mississippi River Basin and the Great Lakes offer potential pathways for invasive species.

Action: Potential for extended (temporary or permanent) closure of locks and other physical structures to impede the continued migration of invasive species. This action will be fully evaluated as an alternative during the Inter-basin Feasibility Study. In lieu of permanent lock closure, MWRD will propose (to USACE) the fabrication and installation at MWRD expense, fine-mesh screens to be placed in-line with the sluice gates at the two locks for discretionary diversion May through October. MWRD will use the pump at Wilmette only for discretionary diversion.

Expected Milestones: Unknown

Potential Hurdles:

- Lock closure alone won't completely prevent water transfer or impede migration of juvenile fish.
- Enforcement of waterway restrictions requires additional resources (manpower and vessels).

2.2.4 Commercial Market Enhancement

Workgroup: IC
Lead Agency: IL DNR
Estimated Funding: \$3,000,000
Funding Source: GLRI monies

Problem: Most if not all biologists agree that there is an urgent need to dramatically suppress Asian carp populations in the Illinois River watershed, including CAWS. Yet with governmental budgets limited, a sustainable mechanism for suppressing carp populations has been elusive.

Action: Expand the commercial market for Asian carp in Illinois and beyond, with a portion of proceeds from carp filets going to fund ecosystem restoration and invasive species prevention. This provides more than one or two benefits. It could provide a “win-win-win:” (1) suppression of carp populations, (2) job creation, (3) enhanced revenue source for programs designed to restore ecosystems, such as the Great Lakes. These monies would be utilized to provide funding opportunities to enhance marketing within the U.S. and export opportunities outside the U.S.

Expected Milestones: Unknown

Potential Hurdles:

- Ensuring that market enhancement does not lead to fishery sustenance, but instead meets the desired biological suppression results, using legal and penal mechanisms.

2.2.5 Rotenone Treatment for Maintenance Shutdowns

Workgroup: IC
Lead Agency: Rapid Response Team (IL DNR, FWS, USCG, etc.)
Estimated Funding: \$5,000,000
Funding Source: Federal funding may be needed if failure of existing barriers occurs

Problem: The barrier system requires periodic maintenance during which the system must be shut down for a period of days. This occurred in December of 2009 and was accompanied by a rotenone application of the Chicago Sanitary and Ship Canal from the barrier 6 miles downstream to the Lockport Lock and Dam. If existing barriers fail or if barrier IIB is not operational by October 2010 then this action would be necessary. Note that this is a contingency scenario.

Action: Barrier 2B is scheduled for completion by October 2010. If USACE determines that Barrier IIA must undergo maintenance before IIB is completed, another Rotenone treatment may be necessary. This action item is calculated to include all costs of this operation (rotenone application, detoxification, monitoring and collection, and logistics support), including both material and labor costs similar to those donated by many partner organizations in 2009. Additionally, a smaller application of rotenone is anticipated when Barrier IIB is completed and barrier IIA undergoes maintenance.

Expected Milestones:

- October 2010 – Barrier IIA maintenance

Potential Hurdles: None

2.2.6 Investigation of Certification Requirements for Asian Carp Usage

Workgroup: IC
Lead Agency: IL DNR, USDA, USAID
Estimated Funding: NA
Funding Source: No funding necessary

Problem: Most if not all biologists agree that there is an urgent need to dramatically suppress Asian carp populations in the Illinois River watershed, including CAWS. Yet with governmental budgets limited, a sustainable mechanism for suppressing carp populations has been evasive.

Action: IDNR will work with Illinois Congressional delegation to identify certification procedures necessary for Asian carp to be declared suitable for use in US sponsored Humanitarian relief efforts.

Expected Milestones: Unknown

Potential Hurdles:

- Ensuring that market enhancement does not lead to fishery sustenance, but instead meets the desired biological suppression results, using legal and penal mechanisms.

2.2.7 Feasibility Assessment of Inter-Basin transfer of AIS

Workgroup: MRR
Lead Agency: USGS
Estimated Funding: \$500,000/yr
Funding Source: USGS GLRI monies

Problem: Continued transfer of Aquatic Invasive Species between the Great Lakes and the Mississippi River Basins in spite of the Dispersal Barrier. Additional hydraulic connections between the two basins could provide transfer and need to be addressed.

Action: 1) Determine the frequency via the surface-water pathway that there was the potential for migration of invasive species from the Des Plaines River to the CSSC during flooding conditions observed previously. 2) Determine the potential for migration of invasive species from the Des Plaines River and/or the I&M Canal to the SSC via groundwater flow through the fractured bedrock that is present between these surface water bodies. The area of investigation is where the Des Plaines River, CSSC, and I&M Canal are located near each other in the vicinity of Lockport, Illinois, which includes the area surrounding the electric fish barrier. The investigation will involve a review of the life cycle of the Asian carp; surface topographic mapping; characterization of the bathymetry and water levels in the Des Plaines River, SSC, and I&M canal; assessment of the fracture network in the karstic bedrock system between these surface-water bodies; characterization of groundwater flow through the fracture network; and assessment of select water-quality parameters in the bedrock. Coordination efforts with USACE to avoid duplication are underway.

Expected Milestones:

- Start Date - FY2010, 2nd Quarter

Potential Hurdles:

- Access issues for field operations.

2.2.8 Investigate Tow Boats and Barges as Potential Vectors

Workgroup: MRR

Lead Agency: USCG, USEPA, IL DNR, FWS, USACE

Estimated Funding: \$500,000

Funding Source: GLRI monies

Problem: A possible AIS dispersal barrier bypass vector has been identified through the transport of Asian carp eggs, gametes, or juvenile fish in ballast/bilge/rake/void water. When tows/barges take on water in ballast operations or through other means south of the barrier, eggs, gametes, or juvenile fish might be inadvertently carried across the barrier and discharged through de-ballasting or dewatering operations. It is important to note that in the interim that USCG has prohibited ballast/bilge water discharge on the lake side of the barrier effective 2009.

Action: Establish a Cooperative Working Group with towing industry reps, fishery biologists, scientists, and agency officials to investigate and study the potential vector of tow boats and barges for transporting Asian carp across the AIS dispersal barrier. Sample barge and tow boats tanks and voids to assess risk and implement risk mitigation measures if warranted.

Expected Milestones:

- February 2010 – Initial convening of working group. Identify leader.
- March 2010 – Develop objectives, methodology and sampling protocols. Identify towing industry participants/locations.
- April 2010 – Complete Statement of Work.
- May 2010 – Secure Funding/Award Contract
- September 2010 – Complete sampling and testing for evidence of Asian carp.
- October 2010 – Report findings and determine risk.
- November 2010 – Implement additional risk mitigation measures if necessary.

Potential Hurdles:

- Finding necessary evidence of species bypass—not just Asian carp eDNA.
- Establishing methodology acceptable to all parties.
- Control of vector pathways during effort to prevent cross-contamination.
- Authority to exceed the IL DNR allocation for discretionary diversion.

2.2.9 Tagged Fish Research to Test Dispersal Barrier Effectiveness

Workgroup: MRR

Lead Agency: IL DNR, FWS, USACE

Estimated Funding: \$400,000

Funding Source: GLRI monies

Problem: Asian carp DNA has been detected above the barrier in several locations. Although no fish have been collected or seen, the presence of DNA strongly suggests that fish may be present. Potential pathways must be identified and evaluated, including the possibility that some fish may be moving through the barrier.

Action: Preliminary work using tagged common carp was conducted by the Illinois Natural History Survey to determine if the demonstration barrier was able to prevent fish from moving across. That project used a very small number of carp and did not have ideal field conditions to permit strong conclusions. Additional work should be directed at Barrier IIA using a much larger sample size, more controlled field conditions, and potentially using sterile Asian carp as test fish. A complementary approach would include use of DIDSON sonar equipment at the barrier site to observe fish behavior and to look for any fish penetrating or crossing the barrier.

Expected Milestones: Unknown

Potential Hurdles: None

2.2.10 Minnow Trade Investigation of Northeast Illinois' Bait Shops

Workgroup: CO

Lead Agency: IL DNR

Estimated Funding: NA

Funding Source: No funding necessary

Problem: In working to prevent Asian carp establishment in the Great Lakes every possible avenue for entrance needs to be addressed while reaching out to the public for assistance and educating them on the dangers.

Action: IDNR will conducting an investigation of bait shops in NE Illinois to identify whether Asian carp are collected and sold as bait in the Chicago area to further reduce the risk of distribution of Asian carp minnows.

Expected Milestones: Unknown

Potential Hurdles:

- Bait shop/public compliance.

2.2.11 Commercial Fishing for Removal Below Lockport

Workgroup: MRR/IC

Lead Agency: IL DNR, USCG, etc.

Estimated Funding: \$300,000

Funding Source: GLRI monies

Problem: In some areas downstream of Lockport Pool, the population density of Asian carp is very high; these fish may be seeking to expand their areas and spread out. By decreasing the numbers downstream, thereby decreasing the propagule pressure; the pressure to expand may also be decreased.

Action: An accepted principle of invasive species control is to remove propagule pressure that would otherwise hasten dispersal of fish into new areas and increase likelihood of invasion. This action will employ commercial fishermen in the pools below the barrier in a sustained program of catch and removal of Asian carp from the system.

Expected Milestones: Unknown

Potential Hurdles: None

2.2.12 Efficacy Study for Toxic Zones Using Plant Effluent

Workgroup: MRR/IC

Lead Agency: MWRD

Estimated Funding: NA

Funding Source: No Federal funding necessary

Action: Use of MWRD plant effluent to create an anoxic zone has been determined unworkable because Asian carp are known to gasp air when in water with low dissolved oxygen (DO) and possibly could survive and transit through an anoxic zone. Wet weather operations would also disrupt an anoxic zone. Another possible approach is to create a toxic zone through the bypass of ammonia-laden primary effluent to the CSSC at the Stickney plant and the Little Calumet River at the Calumet plant. This would create toxic zones to kill fish migrating upstream. These two zones would block passage to the lakefront control structures and serve to assist in the plan for controlled lock operations. The length of the toxic zone, as well as other operating parameters, would have to be determined through study, including the method to remove the ammonia toxicity at the downstream end of the toxic zone. Full-scale testing would be included in the study and would be necessary to verify that the toxicity is present across the entire channel cross-section throughout the zone. Instream mixing may be necessary to accomplish complete dispersal. MWRD envisions a collaborative approach to this applied research with other academic institutions.

Expected Milestones:

- 2011 – Complete literature research
- 2012 – Complete modeling of toxic zones and method of ammonia removal
- 2013 – Full-scale testing in channel

Potential Hurdles:

- Selection of this option would require significant policy considerations related to the Clean Water Act for study and full-scale trials.
- MWRD NPDES permits for these two plants do not include discharge of toxic concentrations of ammonia.

2.2.13 Increased Lacey Act Enforcement of Illegal Transport of Injurious Wildlife

Workgroup: MRR/IC

Lead Agency: USFWS

Estimated Funding: \$400,000

Funding Source: USFWS allocation of GLRI monies

Problem: Although transfer of AIS is currently illegal, and stricter enforcement is necessary to mitigate the risk of transfer.

Action: The FWS will support law enforcement activities related to implementation of the Lacey Act (16 U.S.C. § 3371-3378), as applicable. FWS will support implementation of the injurious wildlife provisions (18 U.S.C. § 42) through regulations contained in 50 *Code of Federal Regulations* (CFR), Part 16. FWS law enforcement personnel will work cooperatively and in coordination with State officials and agencies within the Great Lakes and surrounding region to enforce Federal and State statutes and regulations to support prevention and control of AIS, including Asian carp. Additionally, the FWS will work toward completion of actions needed in advance of rulemaking for listing of bighead carp as injurious under the Lacey Act (black and silver, and large-scale silver carp currently listed). The agency completed some of the steps required in

the rulemaking processes for bighead carp, including a risk assessment, the Initial Regulatory Flexibility Analysis, and an economic analysis, although not all have gone through public review.

Expected Milestones: Unknown

Potential Hurdles:

- Enforcement personnel.
- Timeframe requirements for finalization and approval of injurious wildlife listing for bighead carp through established rulemaking process.

2.2.14 Understanding Bighead Carp and Bluegreen Algae Dynamics

Workgroup: MRR/IC

Lead Agency: USGS

Estimated Funding: \$225,000/yr

Funding Source: USGS GLRI monies

Problem: 1. Bluegreen algae (primarily *Microcystis*) blooms resulting from the dreissenid invasion may provide an excellent food source for bighead carp, enhancing their invasion. 2. Noxious bluegreen algae blooms can under some circumstances be enhanced by interaction with bighead carps.

Action: The risk of enhanced noxious algal blooms, and the possibility that use of bluegreen algae blooms might enhance bighead carp invasiveness, could be assessed by modeling, and parameterized with mesocosm experiments that fill in some of the holes in our understanding of this relationship.

Expected Milestones:

- Map the spatial and temporal extent and cell density of bluegreen algae blooms in the Great Lakes
- Determine bioenergetics of bighead and silver carp feeding on *Microcystis* blooms
- Determine at what densities and conditions bighead carp feeding on *Microcystis* enhances or ameliorates blooms and toxin production by *Microcystis*.

Potential Hurdles:

- Raising *Microcystis* in adequate concentrations in the laboratory environment.
- Hydroclimatic variability of bluegreen algae blooms.

2.2.15 Integrated Pest Management

Workgroup: IC/MRR/CO

Lead Agency: USFWS, states, Tribes, NGOs, local communities

Estimated Funding: \$4,223,000

Funding Source: USFWS allocation of GLRI monies

Problem: Limited funding opportunities for state development of programs specific to AIS.

Action: FWS will provide funds allocated through the Great Lakes Restoration Initiative in FY2010 to states, Tribes, and others to support activities to prevent the introduction of AIS into the Great Lakes. Specific funding has been made available to support activities including implementation of State Aquatic

Nuisance Species Management Plans and related to AIS control within the Great Lakes watershed. This would include development of state-led rapid response actions conducted under new rapid response plans developed by the Great Lakes states and approved by the AIS Task Force. Additionally, funding has been made available through the GLRI in FY2010 to support application of integrated pest management (a combination of physical, chemical, and biological methods) to control invasive species, including Asian carp. Using this program, FWS and its partner agencies would develop, test, implement, and adapt existing and new methods to reduce the abundance of aquatic invasive species, such as Asian carp, in the Illinois Waterway and adjacent waters. Also, funding has been allocated through the GLRI in FY2010 to support activities under the Great Lakes Fish and Wildlife Restoration Act. Through this existing authority and funding mechanism, states, Tribes, and academia may submit proposals for funding consideration through a competitive proposal review process. Projects targeting prevention and control of Asian carp in Great Lakes waters can be submitted for consideration.

Expected Milestones: Unknown

Potential Hurdles: None

2.2.16 State and Interstate Aquatic Nuisance Species (ANS) Management Plans

Workgroup: IC/MRR/CO

Lead Agency: USFWS and eight Great Lake states

Estimated Funding: \$11,000,000

Funding Source: USFWS allocation of GLRI monies

Problem: Limited funding opportunities for state development of programs specific to Aquatic Nuisance Species Management Plans.

Action: FWS will provide funds allocated through the Great Lakes Restoration Initiative in FY2010 to states, Tribes, and others to support activities to prevent the introduction of aquatic invasive species into the Great Lakes. Specific funding has been made available to support activities including implementation of State Aquatic Nuisance Species Management Plans and related to AIS control within the Great Lakes watershed. This would include development of state-led rapid response actions conducted under new rapid response plans developed by the Great Lakes states and approved by the AIS Task Force. Additionally, funding has been made available through the GLRI in FY2010 to support application of integrated pest management (a combination of physical, chemical, and biological methods) to control invasive species, including Asian carp. Using this program, FWS and its partner agencies would develop, test, implement, and adapt existing and new methods to reduce the abundance of aquatic invasive species, such as Asian carp, in the Illinois waterway and adjacent waters. Also, funding has been allocated through the GLRI in FY2010 to support activities under the Great Lakes Fish and Wildlife Restoration Act. Through this existing authority and funding mechanism, states, Tribes, and academia may submit proposals for funding consideration through a competitive proposal review process. Projects targeting prevention and control of Asian carp in Great Lakes waters can be submitted for consideration.

Expected Milestones: Unknown

Potential Hurdles:

- States must provide a 25% match (non-Federal funds) as a requirement for receiving annual funding allocation for support of activities identified in approved State AIS management plans.

2.2.17 Activities to support AIS priorities under the Great Lakes Fish and Wildlife Restoration Act

Workgroup: IC/MRR/CO

Lead Agency: USFWS, states, Tribes, Academia, NGOs

Estimated Funding: \$8,500,000

Funding Source: USFWS allocation of GLRI monies

Problem: Limited funding opportunities for state development of programs specific to AIS.

Action: FWS will provide funds allocated through the Great Lakes Restoration Initiative in FY2010 to states, Tribes, and others to support activities to prevent the introduction of AIS into the Great Lakes. Specific funding has been made available to support activities including implementation of State Aquatic Nuisance Species Management Plans and related to AIS control within the Great Lakes watershed. This would include development of state-led rapid response actions conducted under new rapid response plans developed by the Great Lakes states and approved by the AIS Task Force. Additionally, funding has been made available through the GLRI in FY2010 to support application of integrated pest management (a combination of physical, chemical, and biological methods) to control invasive species, including Asian carp. Using this program, FWS and its partner agencies would develop, test, implement, and adapt existing and new methods to reduce the abundance of aquatic invasive species, such as Asian carp, in the Illinois Waterway and adjacent waters. Also, funding has been allocated through the GLRI in FY2010 to support activities under the Great Lakes Fish and Wildlife Restoration Act. Through this existing authority and funding mechanism, states, Tribes, and academia may submit proposals for funding consideration through a competitive proposal review process. Projects targeting prevention and control of Asian carp in Great Lakes waters can be submitted for consideration.

Expected Milestones: Unknown

Potential Hurdles: TBD

2.2.18 Competitive Funding Opportunities

Workgroup: MRR/IC/CO

Lead Agency: USEPA, FWS

Estimated Funding: \$8,800,000

Funding Source: USFWS allocation of GLRI monies

Problem: Additional funding opportunities for state development of programs specific to Aquatic Nuisance Species are necessary.

Action: FWS will provide funds allocated through the Great Lakes Restoration Initiative in FY2010 to states, Tribes, and others to support activities to prevent the introduction of aquatic invasive species into the Great Lakes. Specific funding has been made available to support activities, including implementation of State Aquatic Nuisance Species Management Plans related to AIS control within the Great Lakes watershed. This would include development of state-led rapid response actions conducted under new rapid response plans developed by the Great Lakes states and approved by the AIS Task Force. Additionally, funding has been made available through the GLRI in FY2010 to support application of integrated pest management (a combination of physical, chemical, and biological methods) to control invasive species, including Asian carp. Using this program, FWS and its partner agencies would develop, test, implement and adapt existing and new methods to reduce the abundance of aquatic invasive species, such as Asian carp, in the Illinois waterway and adjacent waters. Also, funding has been allocated through the GLRI in FY2010 to support activities under the Great Lakes Fish and Wildlife Restoration Act. Through this existing authority

and funding mechanism, states, Tribes, and academia may submit proposals for funding consideration through a competitive proposal review process. Projects targeting prevention and control of Asian carp in Great Lakes waters can be submitted for consideration.

Expected Milestones:

- 2nd quarter 2010 – Review of proposals
- 3rd quarter 2010 – FWS/EPA grants and begin implementation of work

Potential Hurdles:

- Agencies have little control over what is submitted; Asian carp proposal may be lacking.

3.0 GREAT LAKES STATES INVOLVEMENT

This Framework and its proposed actions should serve as a stepping stone from which to strengthen the relationship with the Great Lakes states to reach the common goal of protecting the Great Lakes against Asian carp. As a result of these proposed actions, the Great Lakes states are in a unique position to enhance the unified front throughout each state's individual jurisdiction.

There are several proposed actions contained in the Matrix that are specifically targeted at increasing Great Lakes States programmatic capacity against AIS, by providing a funding vehicle for progress. This would allow the other Great Lakes states an opportunity to leverage their resources and expertise in short-term and long-term actions to keep the Asian carp from establishing themselves in the basin. These measures include:

- Funding opportunities for AIS and prevention program development (See section [2.2.15](#)). There are existing funds, such as the Wild Life and Sport Fish Restoration Grants Program, through which states can apply for grants for AIS, specifically Asian carp, program development within their state or through multi-state collaborations and grants.
- Competitive funding for State response operations and response plan implementation (See section [2.2.18](#)). Additional competitive funding opportunities for FY2010 for state implementation of AIS and Asian carp specific control activities to be implemented.
- Increased pest management program implementation using a combination of physical, chemical and biological methods. (See section [2.2.17](#)) it's important to note that this program addresses one of the nine priorities of the Council of Great Lakes Governors and directly supports State and Interstate Management of Aquatic Nuisance Species Plans approved by the Aquatic Nuisance Species Task Force.
- Preparation of AIS Management Plans (See section [2.2.16](#)). Additional funds have been allocated for FY2010 through GLRI due to the significance of Asian carp control. States are strongly encouraged to utilize these funds to prepare and implement these AIS specific plans and other supporting activities.

USFWS and the Regional Coordinating Committee workgroups will work closely with Great Lakes states to provide assistance where applicable in program development and plan preparation through the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPACA). As amended, it has authorized Federal Support, via USFWS, for State and Interstate AIS Management Plans. Draft plans are approved by the AIS Task Force. All Great Lakes states are implementing, with USFWS grants, either or both State and Interstate AIS Management Plans. Great Lakes States are the primary recipients of the grants, but others can be invited by States to share in grant allocations.

Additional examples of measures states could adopt to protect their waters from Asian carp establishment include:

- Holding consensus building forums with other state and federal agencies. For example, a series of Governor's Policy Summits could be held across the basin to provide solid scientific information to decision makers and the general public on the nature and scope of the issue, and accomplishments and plans to deal with problem, including alternative approaches and impacts. The objective is to begin dialogue that may lead to collaborative regional approaches.
- Considering multi-state coordinated actions to prevent the establishment of Asian carp in the Great Lakes. This will allow actions on a larger scale with potentially pooled resources to increase the effects and reach these potential actions may have.

- Along with provinces, tribes, and local municipalities, investigating the passage of ordinances/laws prohibiting the sale and import/export of live Asian carp (similar to the law already in place in Chicago).

4.0 COMMUNICATION AND OUTREACH

The efficacy of the actions described above and summarized in the Matrix can be significantly enhanced through increased outreach to and participation by other agencies and stakeholders. For example, recreational water sports groups can play a direct role in educating their members and the general public about how they can participate in ways to prevent the transport of invasive species through the Great Lakes watershed. Additionally, NGO volunteers can report any potential sightings of Asian carp to appropriate resource agencies. Many precedents for effective natural resource education programs in the U.S. could be adapted by the agencies participating in this Framework.

Outreach actions that can be implemented concurrently with the programs in the Matrix include:

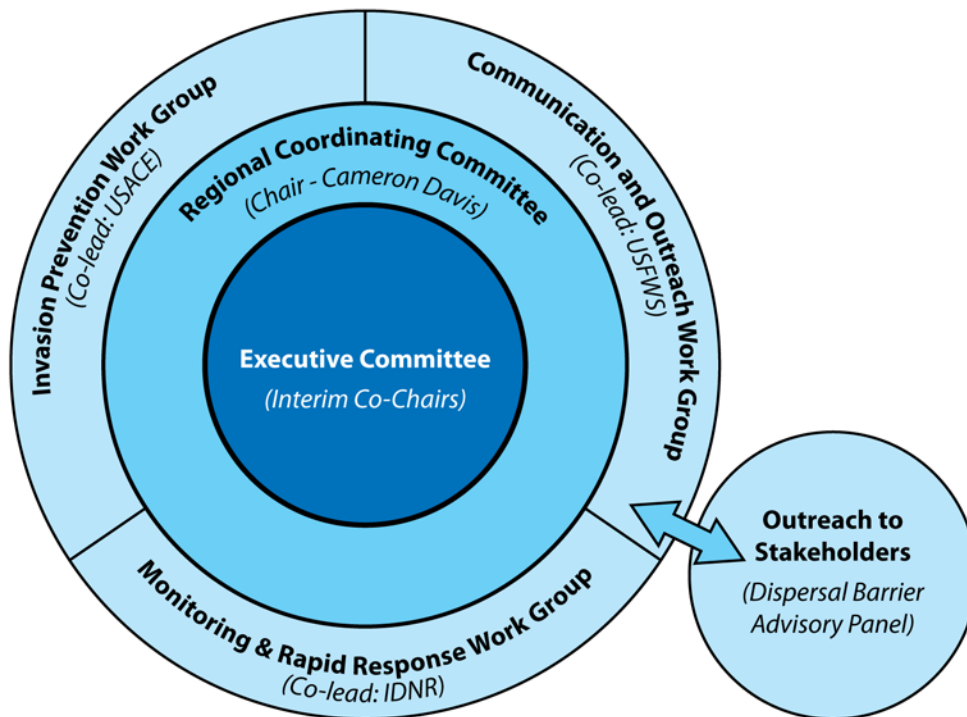
- Inviting participation by stakeholders and user groups in the further development of this Framework. The participating agencies eagerly acknowledge that impeding Asian carp migration is a process, will be impossible to achieve by themselves, and will require stakeholder assistance. As such, outreach meetings are being developed to solicit input. Moreover, ongoing stakeholder participation must continue for both individual actions in this Framework and on the Framework itself.
- Developing and implementing a Community Outreach Plan as part of this Framework. The plan could be similar to Community Involvement Plans developed for the Superfund program. A plan could be subsequently adapted by each agency responsible for outreach. The plan would lay out established facts and consistent definitions from this Framework that each agency must use in its outreach material.
- Identifying a single communications or outreach point of contact (POC) for each agency, with specific responsibilities for briefing elected officials.
- Identifying a single agency contact for media interaction; this POC would likely be USFWS, the lead agency for the Communication and Outreach Workgroup identified in Section 4.0. The Communication and Outreach Workgroup will continue to use www.asiancarp.org and media advisories to disseminate validated information.
- Developing informational material on species recognition and transport prevention for anglers.
- Ready community groups to be employed to disseminate information about the Framework and educate motivated individuals who will also avidly participate in informal monitoring, detection, and reporting programs.

In support of community outreach, the FWS has a public outreach campaign planned which will focus on prevention and control of Asian carp. It will be developed and implemented based on the model of the national "Stop Aquatic Hitchhikers" program. This program will include production and distribution of educational materials including species ID and reporting cards, radio and television public service announcements, billboards, print ads, public displays and exhibits, and web pages.

5.0 COORDINATION STRUCTURE

Exhibit 4 depicts the relationship of the seven primary agency or governmental groups involved in the implementation of the Framework. The relationship is decidedly non-linear because of the need for harmonized input from each group in all facets of the Framework. The Executive Committee consists of the heads of the seven participating agencies listed in Section 1.3; it will be chaired by one or more of the agency heads. The Regional Coordinating Committee is made up of the Senior Executives of the agencies and is chaired by the USEPA. The three work groups surrounding the Regional Coordinating Committee are tasked with the specific responsibilities laid out in the Control Strategy Matrix. Each of the three work groups will be led by representatives from the agencies identified, although the work groups themselves are expected to be comprised of several staff members from each agency. To ensure a unified message for the entire Framework, the function of outreach to additional stakeholders (including the media and government officials) will be the sole responsibility of the Communication and Outreach Workgroup.

EXHIBIT 4. Coordination Structure



6.0 ACRONYMS

AFWA	Association of Fish and Wildlife Agencies
AIS	Aquatic Invasive Species
ANS	Aquatic Nuisance Species
ASA CW	Assistant Secretary of the Army for Civil Works
BAFF	Bio-acoustic Fish Fence
CAWS	Chicago Area Waterway System
CFR	<i>Code of Federal Regulations</i>
CO	Communication and Outreach
CSSC	Chicago Sanitary and Ship Canal
DO	Dissolved oxygen
eDNA	Environmental DNA (Deoxyribose Nucleic Acid)
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
FACA	Federal Advisory Committee Act
FY	Fiscal Year
GLFC	Great Lakes Fishery Commission
GLRI	Great Lakes Regional Initiative
IL DNR	Illinois Department of Natural Resources
I&M	Illinois and Michigan
IP	Invasion Prevention
MSCGP	Multistate Conservation Grant Program
MWRD	Metropolitan Water Reclamation District of Greater Chicago
MRR	Monitoring and Rapid Response
NA	Not Applicable
NEPA	National Environmental Protection Act
NGO	Non-governmental organization
NOAA	National Oceanic and Atmospheric Administration
POC	Point of Contact
RFP	Request for Proposal
RRP	Rapid Response Plan
SPA	Sound Projector Array
TBD	To be determined
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Service
WRDA	Water Resources Development Act

7.0 REFERENCES

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