Binational AIS Rapid Response Planning for the Great Lakes-St. Lawrence River Basin

-Analysis of Jurisdictional Roles and Capabilities-

Prepared for:

Work Group on Aquatic Invasive Species Rapid Response
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PREFACE

This report has been prepared at the request of the International Joint Commission (IJC) Work Group on Aquatic Invasive Species (AIS) Rapid Response. The Work Group has supported the IJC's "Nearshore Priority" over the last several years, advising the IJC and informing its advice to the United States and Canadian governments on binational rapid response planning and implementation.

This is the third in a series of studies undertaken by the Work Group. An initial effort, titled, "Toward a Binational Aquatic Invasive Species Rapid Response Policy Framework" (July 2009), provided the IJC with "strategic and specific policy direction" to facilitate the development and implementation of a binational AIS Rapid Response Plan. That effort was followed by a "Gap Analysis: Asian Carp Rapid Response Planning and Implementation" (August 2011) that further informed rapid response planning efforts by identifying "best practices" and "lessons learned" from the 2009 Asian Carp eradication effort in the Chicago Area Waterways System (CAWS). In addition, two background reports were contracted by the Work Group: "An Assessment of Early Detection Monitoring and Risk Assessments for Aquatic Invasive Species in the Great Lakes-St. Lawrence Basin" (July 2011) and "Aquatic Invasive Species Early Detection and Rapid Response- Assessment of Chemical Response Tools."(July 2011) The study presented within builds upon these efforts.

Appreciation is extended to several Work Group members (Mark Burrows- IJC project manager; Dr. William Taylor, University of Waterloo- Co-chair; Gavin Christie, Fisheries and Oceans Canada - Co-chair) for leadership with project scoping, advice/guidance, and review of various iterations of project deliverables. Other Work Group members include Bill Bolen, U.S. Environmental Protection Agency; Dr. Eugene Braig, Ohio State University; Eric Boysen, Ontario Ministry of Natural Resources; Suzanne Hanson, Minnesota Pollution Control Agency; Dr. Joseph E. Koonce, Case Western Reserve University; Dr. Hugh MacIsaac, University of Windsor; Scott Millard, Fisheries and Oceans Canada; Dr. John Dettmers, Great Lakes Fishery Commission; Brian Grantham, Ontario Ministry of Natural Resources; and Chris Wiley, Transport Canada/ Fisheries and Oceans Canada.

Appreciation is also extended to the Great Lakes Panel on Aquatic Nuisance Species (for hosting a project workshop), and the numerous individuals (i.e., resource managers, response practitioners, researchers) interviewed for this study.

This initiative is supported through Great Lakes Restoration Initiative (GLRI) funding provided by the U.S. Environmental Protection Agency.

The project consultant was Dr. Michael J. Donahue, Vice President for Water Resources and Environmental Services at URS Corporation. He was assisted, on a subcontractual basis, by Dr. Gail Krantzberg and Professor Marcia Valiente. Dr. Donahue was also project consultant and principal author of the two previously mentioned studies.

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EXECUTIVE SUMMARY

The International Joint Commission (IJC) has long recognized the current and potential impact of aquatic invasive species (AIS) in compromising the ecological integrity of the binational Great Lakes-St. Lawrence River Basin and the economic health of Basin residents. In 2007, this issue was identified as one of the IJC's "nearshore priorities" and the Commission formed a Work Group on Aquatic Invasive Species Rapid Response consisting of designated representatives of the Water Quality Board, Science Advisory Board, Council of Great Lakes Research Managers, and invited experts. The Work Group subsequently produced two key studies that acknowledged the continued importance of AIS prevention and control as a "first line" of defense, while also recognizing the need for a "back-up plan"; a rapid response mechanism to quickly and decisively address AIS once an infestation has been reported. The IJC embraced these recommendations, and subsequently secured Great Lakes Restoration Initiative (GLRI) funding from the U.S. Environmental Protection Agency (USEPA) to advance efforts to develop a Binational AIS Rapid Response Plan.

The goal of this project, as stated in the Scope of Work, is to assist the United States and Canadian federal governments in meeting obligations under the recently renegotiated Great Lakes Water Quality Agreement (GLWQA) by providing "advice on binational cooperative action to develop a pilot Binational Aquatic Invasive Species (AIS) Rapid Response Plan for the boundary waters connecting Lake Huron and Lake Erie." Objectives associated with this goal include preparation of a descriptive inventory and analysis of jurisdictional roles and capabilities to support prospective binational AIS rapid response efforts; identification of "key considerations" in developing and implementing a Binational AIS Rapid Response Plan; and development of a pilot plan for the Lake Huron/ Lake Erie Corridor. These and related objectives were addressed through a project methodology featuring two primary tasks: 1) an "Analysis of Jurisdictional Roles and Capabilities in the Great Lakes Basin," focusing on the various federal, state, provincial, binational, Tribal/ First Nations and non-governmental entities with a current or prospective role in AIS rapid response at the binational level; and 2) the "Development of a Pilot Binational AIS Rapid Response Plan for the Boundary Waters of the Detroit-St. Clair River Corridor." *This report addresses the first task and, in so doing, provides a foundation for the second task, to be provided under separate cover.*

This jurisdictional analysis was accomplished through an extensive literature review; a series of in-depth personal interviews with selected researchers, practitioners and other prospective responders; an "Experts Workshop" involving a broader representation of such individuals; and a capabilities assessment of approximately 100 entities (public and nongovernmental) with a current/ prospective role in AIS rapid response in the pilot area selected for the development of a Binational AIS Rapid Response Plan (i.e., the Lake Huron/ Lake Erie Corridor).

The analysis yielded a series of consensus-based findings presented in detail in Section V of this report. Briefly, these findings:

- Confirm that the Lake Huron/ Lake Erie Corridor (Corridor) is a highly appropriate location for the development of a pilot Binational AIS Rapid Response Plan;

- Recognize the value of a pilot plan in assisting both Canada and the U.S. in meeting AIS-related goals and commitments embodied in the recently renegotiated GLWQA;

- Emphasize the immediate need for a Binational AIS Rapid Response Plan capable of rapidly mobilizing agencies, resources and species-specific treatment techniques for newly discovered AIS introductions in the Lake Huron/ Lake Erie Corridor and, more generally, within the binational waters of the Great Lakes-St. Lawrence River Basin;

- Characterize the "institutional infrastructure" of the Lake Huron/ Lake Erie Corridor as highly complex and in need of "harmonization" to ensure a consistent, coordinated and rapid response to AIS introductions;

- Present a series of key organizational, political and scientific challenges that must be addressed in the development of Binational AIS Rapid Response Plan;

- Identify unmet needs (i.e., research gaps) to be addressed in support of plan development; and

- Offer a series of "best practices", drawn from other AIS rapid response settings, to inform plan development content and the structural and operational components of plan maintenance and execution.

In addition, the report presents the outcome of an analysis of approximately 100 Canadian, U.S. and binational entities (public and non-governmental) operating in and/ or relevant to the Lake Huron/ Lake Erie Corridor. These entities were assessed to determine their respective capability (current or prospective) to contribute to binational AIS rapid response in the Corridor in one of three areas: 1) primary planning and execution; 2) planning, scientific and monitoring support; and/ or 3) policy, advocacy, education and outreach support.

Based upon these and other findings, several recommendations are offered to the IJC's Work Group as development of the pilot Binational AIS Rapid Response Plan moves forward:

1. Numerous levels of government (and specific entities) should be considered for key jurisdictional roles and responsibilities in AIS rapid response planning and execution for the Lake Huron/ Lake Erie Corridor. These include International/ Binational (Great Lakes Fishery Commission); Canadian Federal (Fisheries and Oceans, Environment Canada); Provincial (Ontario Ministry of Natural Resources); Canadian Regional/ Local (Conservation Authority, county(ies) and municipality(ies) proximate to the rapid response action); U.S. Federal (U.S. Fish and Wildlife Service, U. S. Environmental Protection Agency); State (Michigan Department of Natural Resources, Michigan Department of Environmental Quality); U.S. Regional/ Local (Southeast Michigan Council of Governments, county(ies) and municipality(ies) proximate to the rapid response action); and Tribal/ First Nations (Walpole Island First Nation, other First Nation Reserves proximate to the rapid response action). It is important to emphasize that multiple other entities have current/ potential capability to

support he primary entities via planning, science and monitoring support, and/or policy, advocacy, education and outreach assistance.

2. Selected existing AIS Rapid Response Plans (i.e., State of Maryland, Lake Champlain) should be used as guidance in developing a pilot plan for the Lake Huron/ Lake Erie Corridor. Plan development should also embrace the "Planning P" approach as used by the U.S. Coast Guard in its Incident Command System (ICS) for emergency response. Finally, guidance on the structural and operational characteristics of plan development and implementation, as presented in an earlier (2009) report to the Work Group ("Toward a Binational Aquatic Invasive Species Rapid Response Policy Framework") should be considered.

3. Research gaps should be addressed promptly to inform the development and application of the pilot plan. Specifically, this includes development of a Corridor-specific listing of high risk AIS, as well as enhanced understanding of inter-species relationships (i.e., between native and invasive species) to facilitate refinement of treatment protocols targeting high risk AIS.

Important Note: This report reflects the outcomes of a process that entailed a detailed literature search, institutional review, personal interviews and consultations, conduct of an "Experts Workshop", and the deliberations of the IJC's Work Group on Aquatic Invasive Species Rapid Response. Earlier drafts of the report were widely circulated for review, and all comments were carefully considered as the final draft was prepared. Report content (including findings and recommendations) is a product of the Work Group alone: it was not the intent of the analysis to secure formal approval from the many agencies and organizations referenced within. Rather, this report is intended to promote dialogue and action among those entities that leads to the development and implementation of a Binational AIS Rapid Response Plan for the Great Lakes-St. Lawrence River Basin.

I. PROJECT BACKGROUND

A. Issue Overview

The International Joint Commission (IJC) has a long-standing interest in the aquatic invasive species (AIS) issue, recognizing the current and potential impact of AIS in compromising the ecological integrity of the binational Great Lakes-St. Lawrence River Basin and the economic health of Basin residents. Toward that end, AIS was identified in 2007 as one of the IJC's "nearshore priorities" and received concerted focus through the formation of a Work Group on AIS Rapid Response. The Work Group has since overseen the development of two key studies:

- "Toward a Binational Aquatic Invasive Species Rapid Response Policy Framework" (July 2009), explored issues and opportunities associated with the development and implementation of a Binational AIS Rapid Response Plan.

- "Gap Analysis: Asian Carp Rapid Response Planning and Implementation" (August 2011) further informed rapid response planning efforts by identifying "best practices" and "lessons learned" from the 2009 Asian Carp eradication effort in the Chicago Area Waterways System (CAWS).

Both of these studies recognized preventive action as the "first line of defense" (i.e., preferred approach) in safeguarding the Great Lake-St. Lawrence River Basin (Basin) from the adverse ecological and economic implications of an AIS infestation. At the same time, however, both studies recognized the need for a "back-up plan"; a rapid response mechanism to quickly and decisively address AIS once an infestation has been reported.

The IJC embraced these recommendations, subsequently securing Great Lakes Restoration Initiative (GLRI) funding from the U.S. Environmental Protection Agency (USEPA) to advance efforts to develop a Binational AIS Rapid Response Plan. In so doing, the IJC recognized that "the ability of the United States and Canadian federal governments to meet Great Lake Water Quality Agreement (GLWQA) objectives will be determined, in part, by the ability of the two nations to successfully identify and implement cooperative solutions to implement AIS prevention and response protocols at the binational level."

B. Project Goal and Objectives

The goal of this project, as stated in the Scope of Work, is to assist the United States and Canadian federal governments in meeting obligations under the GLWQA by providing "advice on binational cooperative action to develop a pilot Binational Aquatic Invasive Species (AIS) Rapid Response Plan for the boundary waters connecting Lake Huron and Lake Erie." Objectives associated with this goal include 1) preparation of a descriptive inventory and analysis of jurisdictional roles and capabilities to support prospective binational AIS rapid response efforts; 2) identification of "key considerations" in developing and implementing a Binational AIS Rapid Response Plan; and 3) development of a pilot plan for the Lake Huron/

Lake Erie Corridor. These and related objectives are reflected in the project methodology summarized below.

C. Project Tasks and Methodology

The project methodology is centered around two primary tasks (and multiple sub-tasks) that collectively address the above stated goal and objectives.

Task One, "Analysis of Jurisdictional Roles and Capabilities in the Great Lakes Basin," focuses on the various federal, state, provincial, binational, Tribal/ First Nations and non-governmental entities with a current or prospective role in AIS rapid response at the binational level. Subtasks include:

1) Compilation of a descriptive inventory of relevant institutional arrangements in the binational Great Lakes-St. Lawrence River Basin including public (i.e., federal, state, provincial, local, binational, First Nations, tribal authorities) and non-governmental entities (i.e., citizen organizations, user groups, academic institutions, business/ industry and other professional associations);

2) Conduct of interviews with selected researchers, practitioners and other prospective responders to contribute to the institutional analysis and assist in framing the development of a pilot Binational AIS Rapid Response Plan for the Lake Huron/ Lake Erie Corridor;

3) Assessment of institutional capabilities to determine the current/ prospective ability of various institutions to lead/ support binational AIS rapid response actions; and

4) Identification and analysis of key considerations for jurisdictions in plan execution.

These four sub-tasks roll up into a single Task One report (on jurisdictional roles and capabilities) that provides a foundation for a second and final task.

Task Two, *"Development of a Pilot Binational AIS Rapid Response Plan for the Boundary Waters of the Detroit-St. Clair River Corridor"* is designed to "illustrate and present the factors to be considered" in the development of a Binational AIS Rapid Response Plan. This task demonstrates how multiple jurisdictions will a) organize to respond to an invasive species discovery; and b) adapt to incidents triggered by "high risk" invasive species. Subtasks include:

1) Analysis and characterization of "high risk" species and associated pathways that pose a prospective threat to the Lake Huron/ Lake Erie Corridor. Items to be addressed include the biology of the individual species; associated ecological impacts; the nature, immediacy and severity of the threat; likely pathways; monitoring requirements; response alternatives where known (i.e. containment, eradication); and relevant experiences elsewhere that offer guidance in formulating a response;

2) Identification and assessment of a continuum of alternatives for binational AIS rapid response, ranging from those readily established within existing authorities, regulations and budgets to those that may require a significant departure from the status quo and require a longer time frame;

3) Conduct of a workshop to gather expert opinion on desirable plan components, and subsequently gather advice on key structural and operational components of plan development and execution;

4) Detailed development of a "preferred" plan in consultation with the IJC Project Manager and Work Group. This will be an iterative process with 10%, 50% and 100% drafts for review; and

5) Conduct of a second workshop to "ground truth" and refine the draft plan. Workshop components will include a presentation of plan elements and rationale; a "walk through" to simulate rapid response actions under the plan; and review of actions to be taken to adopt the plan and verify its full and effective implementation.

These five sub-tasks roll up into a separate Task Two report that lays the foundation for a Binational AIS Rapid Response Plan through a pilot plan for the Lake Huron/ Lake Erie Corridor.

D. Deliverables

This report constitutes one of two primary project deliverables, and consists of a descriptive institutional analysis; an assessment of institutional capabilities to support binational AIS rapid response actions; and key considerations for plan development and implementation, including an analysis of the "top five" problems that jurisdictions must consider. In addition, alternative approaches to AIS rapid response are examined, and the characteristics of a "preferred" approach are presented. "Supporting" deliverables, as specified in the Scope of Work, include a questionnaire to guide the interview process with resource managers, responders and researchers; and various "graphical and non-narrative illustrative materials" to demonstrate (among others) the roles and relationships of various public and non-governmental entities in responding to AIS invasions.

The second component, a *Pilot Binational AIS Rapid Response Plan for the Lake Huron/ Lake Erie Corridor*, will present, in detail, the structural and operational characteristics of a pilot Binational AIS Rapid Response Plan. In addition, this second component will present recommendations to facilitate plan implementation in other binational locations in the Great Lakes-St. Lawrence River Basin. "Supporting" deliverables include (among others) a prioritized listing of "high risk" AIS (as determined by the Great Lakes Panel on Aquatic Nuisance Species); scenarios demonstrating how various "high risk" AIS must be addressed; and recommended procedures that Basin jurisdictions can realistically adopt to assist the IJC in providing "effective and scientifically supportable" advice to the United States and Canadian federal governments under the GLWQA.

II. The Lake Huron/ Lake Erie Corridor as a Pilot Study

A. Defining Pilot Study Boundaries

The IJC Scope of Work calls for the "development of advice on binational cooperative action to develop a pilot Binational Aquatic Invasive Species (AIS) Rapid Response Plan for the boundary waters connecting Lake Huron and Lake Erie." In so doing, the IJC called for this study to facilitate plan implementation in other binational locations in the Great Lakes-St. Lawrence River Basin that might warrant a similar pilot study approach.

Figure 1: Great Lakes-St. Lawrence River Basin

The study boundaries encompass the southernmost portion of Lake Huron at the headwaters of the St. Clair River through the outlet of the Detroit River at the westernmost portion of Lake Erie, including all watersheds draining into those waters. The latter are relevant given that they may provide pathways and/ or habitat with the potential to facilitate the establishment and proliferation of AIS within the Lake Huron/ Lake Erie Corridor.

Having said this, all aspects of the jurisdictional analysis and pilot plan are cognizant of the fact that the Lake Huron/ Lake Erie Corridor is one component of a larger binational system and, therefore, AIS prevention and control actions in the Corridor both affect, and are affected by those in the larger system. The Great Lakes-St. Lawrence River Basin is depicted in Figure 1, while the Lake Huron/ Lake Erie Corridor is depicted in Figure 2.

B. Physical and Biological Characteristics

The Lake Huron/ Lake Erie Corridor connects the southern end of Lake Huron (at the headwaters of the St. Clair River) with the northwestern portion of Lake Erie (at the outlet of the Detroit River). Thus, the Corridor includes the St. Clair River, Lake St. Clair, the Detroit River, all tributaries and associated watersheds. This corridor is approximately 108 miles or 174 kilometres (km) in length and, collectively, the St. Clair River, Lake St. Clair and Detroit River watersheds encompass approximately 12,217 square miles or 31,642 square kilometres (km^2) of land. The Corridor is a vitally important ecological component of the Great Lakes-St. Lawrence River Basin as it connects the upper and lower Great Lakes, is a major conduit for fish species and other aquatic life, and is home to Lake St. Clair, the most biologically productive component of the larger system. The Corridor provides over 90 percent of the average annual water supply to Lake Erie and approximately 75 percent to Lake Ontario. Further, it is home to the largest freshwater delta in the world and supports 65 species of fish, 16 of which are classified (by federal, state and provincial agencies) as threatened or endangered.

Figure 2 Pilot Study Area
LaKe Huron/ Lake Erie Corridor

As noted below, the magnitude and extent of these stressors is reflected in the fact that the Corridor is home to five of the 43 designated Areas of Concern (AOCs) throughout the Great Lakes-St. Lawrence River Basin (i.e., St. Clair River, Clinton River, Rouge River, River Raisin, Detroit River). Thirteen of the 14 Beneficial Use Impairments (BUIs) identified in the GLWQA are found in one or more of these AOCs (i.e., all but degradation of phytoplankton and zooplankton populations). The last two decades have seen a continued, concerted effort to characterize these stressors and initiate targeted restoration projects

designed to de-list the BUIs and, ultimately, de-list the AOC. The impacts of invasive species figures prominently in all five AOCs.

The St. Clair River connects Lake Huron and Lake St. Clair, flowing for approximately 41 miles (90 km) and serving as both a major commercial navigation corridor and the international boundary between the United States and Canada. The river, with an average flow rate of approximately 182,000 cubic feet per second (cfs) or 5,154 cubic metres per second (cms), is generally a straight channel characterized by significant reaches of hardened shoreline (e.g., retaining walls), some narrow beaches, and vegetated cliffs. Associated with the river system is an extensive delta at its outlet, featuring substantial wetlands in the St. Johns Marsh on the west (near Anchor Bay in Michigan) and on the north shore of Mitchell's Bay in Ontario. Despite these ecologically significant features, human uses of St. Clair River have dramatically altered the natural processes of the system, and the great majority of the watershed's original landscape has been replaced by residential, commercial and/or agricultural development. Ten of the 14 BUIs are associated with the St. Clair River AOC. As the St. Clair River enters Lake St. Clair, the flow decelerates with high amounts of suspended sediment that the river brings from Lake Huron, forming the St. Clair Delta, commonly regarded as the largest in the world.

Lake St. Clair is a shallow lake with an average depth of approximately 12 feet or 3.7 metres (m) and a maximum natural depth of just over 21 feet (6.4 m), its navigation channel is dredged to 27 feet (8.2 m) to accommodate commercial vessels. The lake is approximately 26 miles (41.8 km) long and 24 miles (38.6 km) wide, with a surface area of 470 square miles (1,217 km^2) and 130 miles (209 km) of shoreline. The Michigan portion of the watershed is highly urbanized with dense coastal development. In contrast, the eastern portion in Ontario is comprised of the wetlands of the Walpole Island First Nation and low-lying areas with both diked and undiked marshes that provide habitat for migrating waterfowl. Land use on the eastern shore is predominantly agricultural and recreational in nature, with the southern shore characterized primarily by residential and recreational uses.

Lake St. Clair is highly productive from a biological standpoint and, at the 2000 State of the Lakes Ecosystem Conference (SOLEC), was identified as a "Biodiversity Investment Area"- a designation provided to ecologically significant areas of the Great Lakes-St. Lawrence River Basin that are characterized by high concentrations of rare species and/or high quality natural communities. The lake was also recognized by SOLEC as a priority "eco-reach" providing critical habitat for a variety of plant and animal species, particularly in coastal wetlands.

The Clinton River is the major U.S. tributary to Lake St. Clair, and its lower segment is a designated AOC with eight BUIs. On the Canadian side, major tributaries include the Sydenham and Thames Rivers, which drain highly productive agricultural areas.

The lake's shallow depth, wind strength and direction have significant impacts on water levels and circulation patterns. Ice build-up in the Detroit River can affect the lake's water levels on a short-term basis by reducing flows and backing up water volume. Similarly, storm events and wind patterns can also alter flow volumes in the river, resulting in a temporary increase in the level of the lake.

The Detroit River, extending some 28 miles (61.6 km), connects Lake St. Clair to Lake Erie, the most biologically productive of the Great Lakes. The river, with an average flow rate of 188,000 cfs (5,324 cms), provides a connection between the colder and deeper upper Great Lakes (Lakes Superior, Michigan and Huron) and the warmer and shallower lower Great Lakes (Lakes Erie and Ontario). The Detroit River was designated an AOC in 1987, and has been assigned 11 BUIs. The river is a moderately productive ecosystem and an important migratory corridor for fish and waterfowl. It is heavily utilized for fishing, recreation and as an international shipping corridor. The Michigan Department of Natural Resources (MDNR) and Ontario Ministry of Natural Resources (MNR) recognize the Detroit River as one of the most ecologically diverse water bodies in the Great Lakes-St. Lawrence River Basin, with over 65 fish species and 29 species of waterfowl.

C. Socio-economic and Demographic Characteristics

The waters of the Lake Huron/ Lake Erie Corridor have had a longstanding influence on the socio-economic and demographic characteristics of the area. The Corridor continues to be a defining feature of southeast Michigan and southwest Ontario, where some six million residents are found in the Lake St. Clair/ St. Clair River Watershed. An inextricable linkage between the Corridor's water resources and predominant economic activity is evident. Such water-based activity includes, among others, recreational fishing and boating, swimming, hunting, water-based tourism, commercial navigation, coastal residential development, and water-dependent industry.

A selective listing of socio-economic data from the "St. Clair River and Lake St. Clair Comprehensive Management Plan" (2004) is illustrative:

- Commercial vessels annually make up to 5,000 transits across the Corridor, one of the busiest commercial navigation routes in North America.

- In 2000, products shipped into/ out of the Port of Detroit accounted for more than 10,000 jobs, over $550 million (M) in total income (US dollars) and approximately $165M (US) in business revenue.

- Communities within/ adjacent to the Corridor are heavily dependent upon Lake St. Clair, and the St. Clair and Detroit Rivers, for drinking water.

- Portions of the waterfront are heavily industrialized on both the Canadian (e.g., Sarnia, ON) and U.S. sides (e.g., Detroit, MI and "downriver" communities), where ready access to water for manufacturing processes and commercial navigation are available. This includes petroleum refineries, chemical manufacturers, paper companies, salt producers and thermal electric generation facilities.

- The Corridor claims the highest concentration of recreational boats in the state of Michigan, with Lake St. Clair contributing more than $249M (US) in annual recreational boating benefits to three Michigan counties (Macomb, Oakland, St. Clair).

- Approximately 225 recreational marinas are found on the Canadian and U.S. sides of the St. Clair River and Lake St. Clair. On the U.S. side alone, some 200,000 boats are registered in the four counties adjacent to/ near Lake St. Clair.

- The Corridor is characterized by extensive outdoor recreation facilities including park systems, beaches, campgrounds and marinas.

- The Lake St. Clair sport fishery is among the most valuable in the world and, despite its small size (relative to the entire Great Lakes system), it accounts for 33% of all fish (and 48% of all sport fish) caught in the Great Lakes.

The demographic characteristics of the Corridor vary widely. The U.S. portion is highly urbanized, with dense residential development throughout and extensive industrial facilities along various reaches of the waterfront (particularly in Detroit and "downriver" communities.) Land use changes in recent decades, according to the Southeast Michigan Council of Governments (SEMCOG) suggest a continuing trend toward residential and non-residential development, with an associated loss of agricultural and undeveloped land. Population forecasts by SEMCOG (through 2030) suggest double digit percentage increases in the upper Corridor (i.e., St. Clair, Macomb and Oakland Counties) and overall population loss in the lower portions of the Corridor and, principally, Wayne County.

In contrast, the Canadian portion of the Corridor is generally characterized by agricultural and recreational land uses, undeveloped areas (including diked and undiked marshes), medium density residential development in a few urban areas, and pockets of intensive industrial development, most notably in the Sarnia area. Agriculture continues to be the predominant land use (and economic sector) within the Lake St. Clair/ St. Clair River Watershed (75%), followed by urban (13%) and woods/wetlands (12%). Population forecasts by the Ontario Ministry of Finance project modest growth rates for counties within the Corridor through 2021, with modest urban land development and continued dominance of agricultural/ rural land use.

D. Governance Characteristics: The Corridor's "Institutional Infrastructure"

The characteristics of the "institutional infrastructure" in the binational Lake Huron/ Lake Erie Corridor generally mirror those of the larger binational Great Lakes-St. Lawrence River Basin, both with regard to AIS rapid response and, more generally, resource management in a binational setting. This "institutional infrastructure" pertains to the range of agencies and organizations (both public and non-governmental) with a current/ prospective role or interest in AIS rapid response, as well as related laws, agreements, policies and programs that dictate or otherwise influence approaches to AIS rapid response.

As noted in a previous report to the IJC's AIS Rapid Response Policy Framework Work Group ("Toward a Binational Aquatic Invasive Species Rapid Response Policy Framework", 2009) this infrastructure is highly complex for a variety of reasons, including the physical size of the basin, its binational/ multi-jurisdictional character, and the pervasive nature of AIS impacts (i.e., ecological, social, economic). The complexity of this institutional infrastructure poses both challenges and opportunities in designing an AIS rapid response plan in a binational setting.

Organizational, leadership and resource allocation challenges can be formidable and, among others, include:

- The hesitancy of public agencies (at any level) to assume leadership responsibilities in the absence of a clear legislative directive or funded mandate;

- The prospective liability associated with AIS rapid response activities;

- The requisite investment of political capital to develop and maintain a program that includes both AIS rapid response capability and the decision support system upon which it must rely; and

- The challenge of "harmonizing" inconsistencies in legislation, policies and programs (both at the domestic and binational levels) to ensure that all relevant parties approach AIS rapid response with a consistent set of goals and objectives.

Opportunities, however, are also found within the "institutional infrastructure", both at the binational Lake Huron/ Lake Erie Corridor level and, more generally, within the binational Great Lakes-St. Lawrence River Basin. They include, among others:

- A highly developed and sophisticated institutional structure that includes an array of binational public and non-governmental entities that can contribute to AIS rapid response;

- A tradition of collaboration among public agencies at both the domestic and binational levels; and

- Several decades of experience with AIS prevention and control, as well as with rapid response to other emergencies (e.g., oil and hazardous material spills) that offer "lessons learned" in plan development and implementation.

Section III of this report, titled "Jurisdictional Roles, Authorities and Capabilities for Rapid Response" presents a detailed, descriptive inventory and assessment of dozens of public and non-governmental entities potentially relevant to AIS rapid response in the Lake Huron/ Lake Erie Corridor (i.e., international, binational, federal, state, provincial, municipal, tribal/ First Nations, non-governmental, business/industry, academia).

E. AIS High Risk Species of Concern

The Lake Huron/ Lake Erie Corridor is among the most vulnerable areas of the Great Lakes-St. Lawrence River Basin with regard to the infestation and establishment of AIS populations. As the sole hydrologic connection between the lower and upper components of the Basin System, the Corridor is a major migration route for a range of species. Further, much of the Corridor is characterized by dense residential, commercial and industrial development and a range of water-based activities that can advance the introduction and establishment of AIS (e.g., commercial navigation, recreational boating, sport fishing).

The Corridor's diverse hydrologic characteristics (e.g., fast flowing river, numerous tributaries, back water areas, wetlands) and biological productivity not only facilitate the establishment of AIS populations, but also pose significant challenges in the selection and execution of rapid responses. Lake St. Clair, for example, was home to the initial discovery of zebra mussels in the Great Lakes-St. Lawrence River Basin in 1988, followed two years later by the discovery of the round goby in the St. Clair River. The "Biodiversity Atlas of the Lake Huron to Lake Erie Corridor" (Wildlife Habitat Council, 2002) identifies AIS as the "second greatest threat" to the Corridor's ecosystem, with habitat loss as the leading concern.

A review of the literature, coupled with inquires to several of the individuals interviewed for this study, confirmed that there is presently no definitive list of "high risk" AIS specific to the Lake Huron/ Lake Erie Corridor. However, three lists focused at the broader, Basin-wide level were identified as having potential relevance for rapid response planning efforts in the Corridor. They include the following:

- **Great Lakes Priority Invasive Species List:** Developed in 2005 and regularly updated by the Great Lakes Panel on Aquatic Nuisance Species, this list is "intended to draw attention to those organisms with known and significant adverse impacts on the Great Lakes-St. Lawrence River ecosystem, its users and uses." It is presently comprised of 27 species in the categories of fishes (9); zooplankton (2); plants (7); macroinvertebrates (4); pathogens (4); and phytoplankton (1). Of these species, 20 are identified as "Tier 1" (i.e., established, harmful, non-native) and seven species are identified as "Tier 2" (i.e., potentially harmful invaders). The list is managed by the Panel's Research Coordination Committee (comprised largely of public agency managers and academic researchers). The following criteria are used to consider species for inclusion: proven or potential ability for significant adverse impacts; not intentionally introduced or managed; no demonstrated beneficial use; likelihood of constituting an emerging threat; and no economically viable means of control.

- **Great Lakes Aquatic Nuisance Species Information System (GLANSIS):** Maintained by the National Oceanic and Atmospheric Administration- Great Lakes Environmental Research Laboratory (NOAA- GLERL), GLANSIS is a node of the U.S. Geological Survey (USGS) Nonindigenous Aquatic Species (NAS) data base. The list presently includes over 180 species, and targets aquatic nuisance species that "are not considered to have been native to any part of the Great Lakes basin." GLANSIS also includes a "watchlist" of 53 species with the potential to become established in the Great Lakes-St. Lawrence River Basin. Categories include crustaceans (21), fishes (19), mollusks- bivalves (1), plants (6), rotifers (3), platyhelminthes (1), annelids- polychaetes (1), and bryozoans (1). Species include only those established below the ordinary high water mark, including connecting channels, wetlands and waters ordinarily attached to the Lakes. (Those that have invaded the Basin's inland lakes but do not otherwise meet the geographic criterion are not included.) Further, the list includes only nonindigenous species defined as follows (based on Ricciardi 2006): the species has appeared suddenly and has not been previously recorded in the Basin; it subsequently spreads within the Basin; it has a restricted distribution compared to that of native species; its global distribution is characterized by widely scattered and isolated populations; its distribution is

associated with human vectors of dispersal; and the Basin is isolated from regions that possess similar species (from genetic and morphological standpoints.)

- **Non-Native Species of Concern and Dispersal Risk:** This listing is one product of the ongoing, multi-year Great Lakes-Mississippi River Interbasin Study (GLMRIS) undertaken by the U.S. Army Corps of Engineers (USACE). The study is investigating "the range of options and technologies available to prevent the spread of Aquatic Nuisance Species between the Great Lakes and Mississippi basins via aquatic connections." The study notes that the "main conduit of concern" is the CAWS. This comprehensive analysis entailed a review of over 650 publications, followed by a screening process that began with 254 species and resulted in 39 "high risk" species on the basis of criteria that included professional judgment; literature review; proximity to CAWS; ecological tolerances and needs; and vagility. Of these 39 species, 10 are of concern to the Great Lakes, and include a scud, skipjack herring, northern snakehead, silver carp, bighead carp, inland silverside, black carp, dotted duckweed, marsh dewflower, and Cuban bulrush.

A review of these and related compilations concluded that the "Great Lakes Priority Invasive Species List" maintained by the Great Lakes Panel is most relevant to rapid response planning in the Lake Huron/ Lake Erie Corridor (see Table 1). An ever-evolving, consensus-based list developed by the Panels' Research Coordination Committee (comprised largely of resource managers and academic researchers), it is targeted specifically at "high risk" species with known (or suspected) significant adverse impacts and, therefore, species most likely to trigger a rapid response. Having said that, other lists add value as well. While the GLANSIS list does not categorize AIS on the basis of risk, it is firmly grounded in the peer-reviewed literature, and includes a comprehensive listing of all AIS identified to date, as well as a "watch list" of prospective invaders. Further, while the GLMRIS list focuses specifically on prospective invaders through a single pathway (CAWS), it's equally rigorous process and detailed assessment of those prospective invaders has direct relevance to rapid response needs in the Lake Huron/ Lake Erie Corridor.

An ongoing USFWS initiative of relevance is the implementation of a rapid risk assessment process on 1,400 species. Reports on some of these species are now available and additional reports are being added on a regular basis. Risk of establishment in the Lake Huron/ Lake Erie Corridor (and, more generally in the Great Lakes-St. Lawrence River Basin) is evidenced by the climate match provided in each report, and the category of risk and risk of impact are detailed as well.

As AIS rapid response efforts move forward in the Lake Huron/ Lake Erie Corridor, additional work will be needed to develop a listing a high risk AIS *specific* to the Corridor. In addition, further study of the nature of inter-species relationships (i.e., between native and invasive species) will be required to develop and refine treatment protocols (i.e., chemical, mechanical, biological) that effectively target high risk AIS without undue adverse impacts on native species.

Table 1

Great Lakes Panel on Aquatic Nuisance Species
Priority Invasive Species List - 2008

Tier 1 = established, harmful, non-native
Tier 2 = potential harmful invader

Grouping	Tier	Common Name	Taxon	Species	Origin	Date	Location	Mechanism	Justification
Fish	2	silver carp (Asian carp)	Cyprinidae	*Hypophthalmichthys molotrix*	Asia	ST	N/A	Release (Aquaculture, Accidental)	Closing in on the Great Lakes via river systems; significantly outcompetes native fish and greatly reduces or eliminates fish biodiversity; also a threat to human health by jumping impact
	2	bighead carp (Asian carp)	Cyprinidae	*Hypophthalmichthys nobilis*	Asia	ST	N/A	Release (Aquaculture, Accidental)	Closing in on the Great Lakes via river systems; significantly outcompetes native fish and greatly reduces or eliminates fish biodiversity; also a threat to human health by jumping impact
	2	black carp (Asian carp)	Cyprinidae	*Mylopharyngodon piceus*	Asia	ST	N/A	Release (Aquaculture, Accidental)	A voracious molluscivore, likely to threaten native mussel populations
	2	grass carp (Asian carp)	Cyprinidae	*Ctenopharyngodon idella*	Asia	ST	N/A	Release (Deliberate)	Can reduce submerged rooted vegetation to such degree that essential habitat & sediment stability are severely compromised.
	1	Eurasian ruffe	Percidae	*Gymnocephalus cernuus*	Eurasia	1986	St. Louis River (S)	Shipping (Ballast Water)	Competition for forage, predation on native species
	1	round goby	Gobiidae	*Neogobius melanostomus*	Eurasia	1990	St. Clair River (StC)	Shipping (Ballast Water)	Aggressive predator, outcompete native fish, raids native fish nests, takes over native fish habitat
	1	sea lamprey	Petromyzontidae	*Petromyzon marinus*	Atlantic	1830s	Lake Ontario	Canals, Shipping (Fouling)	Well doumented threat to survivial of Great Lakes sports fish (esp. trout and salmon); present control measures are costly and imperfect.
	1	white perch	Perichthyidae	*Morone americana*	Atlantic	1950	Cross Lake (O)	Canals	Competition for forage, predation on native species
	2	northern snakehead	Channidae	*Channa argus*	Asia and Russia	ST	N/A	Release (Fish Markets)	Adverse impact on native fisheries through direct predation, resource competition and the alteration of food webs
Zooplankton	1	fish-hook waterflea	Cladocera	*Cercopagis pengoi*	Black Sea	1998	Unknown	Unknown	Clogs fishing nets and lines, decreases nutrition in juvenile fish, competes with essential native zooplankton for food
	1	spiny water flea	Cladocera	*Bythotrephes longimanus*	Eurasia	1984	Lake Huron	Shipping (Ballast Water)	Competition for forage, predation on native species
Plants	2	Brazilian elodea	Hydrocharitaceae	*Egeria densa*	South America	N/A	N/A		Adverse habitat and recreation impacts
	1	curly pondweed	Potamogetonaceae	*Potamogeton crispus*	Eurasia	1879	Keuka Lake (O)	Release (Deliberate, Fishing)	Adverse habitat and recreation impacts
	1	Eurasian water milfoil	Haloragaceae	*Myriophyllum spicatum*	Eurasia	1952	Lake Erie	Release (Aquarium, Accidental)	Adverse habitat and recreation impacts
	1	European frog-bit	Hydrocharitaceae	*Hydrocharis morsus-ranae*	Eurasia	1972	Lake Ontario	Release (Aquarium, Delib.), Ship fouling	Adverse habitat and recreation impacts
	2	hydrilla	Hydrocharitaceae	*Hydrilla verticillata*	Eurasia	ST	N/A		Adverse habitat and recreation impacts
	1	water chestnut	Trapaceae	*Trapa natans*	Eurasia	<1959	Lake Ontario (T)	Release (Accidental, Aquarium)	Adverse habitat and recreation impacts
	1	phragmites, common reed and giant reed	Poaceae	*Phragmites australis*	North America and Europe	1800s	Unknown	Shipping (Ballast Water)	Outcompetes and eliminates other marsh species with similar habitat requirements
Macroinvert.	1	amphipod	Amphipoda	*Echinogammarus ischnus*	Black Sea	1995	Unknown	Unknown	Outcompetes and displaces native amphipod species in select habitats
	1	mud snail	Gastropoda	*Potamopyrgus antipodarum*	New Zealand	1991	Unknown	Unknown	Reduces diversity by competing with other macroinvertebrates for food and habitat
	1	quagga mussel	Dreissenidae	*Dreissena rostriformis bugensi*	Eurasia	1991	Lake Ontario	Shipping (Ballast Water)	Dominant benthic settler, crowds out other benthic organisms, changes character of benthic habitat, damages submerged structures, clogs unwater pipelines, eliminates native plankton at bottom of food web, diverts food energy to bottom habitat.
	1	zebra mussel	Dreissenidae	*Dreissena polymorpha*	Eurasia	1988	Lake St. Clair	Shipping (Ballast Water)	Dominant benthic settler, crowds out other benthic organisms, changes character of benthic habitat, damages submerged structures, clogs unwater pipelines, eliminates native plankton at bottom of food web, diverts food energy to bottom habitat.
Pathogens	1	parasite	Microsporidea	*Heterosporis spp.*	???	2000	Lake Ontario	Pet Release	Adverse fish condition and recreation impacts
	1	myxosporidian	Myxozoa	*Sphaeromyxa sevastopoli*	Black Sea	1994	Unknown	Unknown	Adverse fish condition impacts
	1	salmonid whirling disease	Protozoa	*Myxobolus cerebralis*	Unknown	1968	Ohio (E)	Release (Fishing)	Adverse population impacts
	1	VHS (viral hemorrhagic septicemia) virus	Rhabdoviridae	*Novirhabdovirus sp.*	North America	2006	Lake St. Clair	Unknown	Implicated in the mortality of significant numbers of fish, especially trout
Phytoplankton	1	Cylindro blue-green algae	Cyanobacteria	*Cylindrospermopsis raciborskii*	Unknown	1971	Lake Erie	Unknown	Forms large subsurface blooms; produces a toxin that may result in gastrointestinal illness in humans and potential chronic liver damage; some strains produce a neurotoxin (although so far these have only been found in Brazil); toxins also are detrimental to zooplankton and invertebrate grazers. Can co-occur with surface scum forming algae like Microcystis by taking up a niche lower in the water column (1-2 m deep).

F. Current State of Rapid Response Planning in the Corridor

A series of developments over the last two decades have gradually moved public entities in the Great Lakes-St. Lawrence River Basin (and Lake Huron/ Lake Erie Corridor) closer to the development of a Binational AIS Rapid Response Plan. Among others, this has included:

- A pronounced increase in public awareness and policy actions, largely due to the discovery and rapid spread of certain species (e.g., Eurasian ruffe, zebra/ quagga mussel, Asian carp);

- The emergence of an elaborate framework of AIS-focused laws, regulations, policies and programs, including multiple interjurisdictional and binational entities (e.g., Aquatic Nuisance Species Task Force (ANSTF) at the U.S. federal level, Great Lakes Panel on Aquatic Nuisance Species at the binational level);

- A proliferation of lake and jurisdiction-specific AIS Management Plans (some of which now address rapid response actions), as well as the development of a model Great Lakes AIS Rapid Response Plan (prepared by the Great Lakes Commission for the Great Lakes Panel on Aquatic Nuisance Species). Other relevant initiatives include an "Emergency Response Plan for Viral Hemorrhagic Septicimia" (2008) prepared by the National Park Service (NPS) in partnership with the Grand Portage Band of Lake Superior Chippewa, and a "Quagga/ Zebra Mussel Infestation Prevention and Response Planning Guide" prepared by NOS in 2007;

- The successful application of rapid response protocols, many employing the Incident Command System (ICS) framework, to a variety of areas including human and animal disease, forest pathogens and insects, invasive plants, fire management, and oil and hazardous material spills;

- The recognized relevance of the CANUSLAK Annex to the GLWQA (i.e., "Joint Marine Pollution Contingency Plan") as a prospective institutional and procedural model for AIS Rapid Response in a binational setting;

- Preparation, under U.S. Environmental Protection Agency (USEPA) leadership, of an "Asian Carp Monitoring and Rapid Response Framework";

- Preparation of a "Preparedness and Response Plan" and an "Incident Management Team Implementation Plan" by USEPA- Region V, both of which have prospective applications in the event of an AIS introduction;

- Preparation of a "Proposed 2010 Plan for the Prevention, Detection, Assessment and Management of Asian Carps in Michigan Waters" by MDNR, Fisheries Division Special Report 60, May 2012;

- Preparation of a "Canadian Rapid Response Framework for Aquatic Invasive Species" by the Canadian Science Secretariat, Fisheries and Oceans Canada (DFO), (Research Document 2010/114);

- Preparation of an "Asian Carp Rapid Response Plan" by the MNR;

- The successful conduct of AIS Rapid Response "table top" exercises undertaken in Pennsylvania and Illinois in 2008, and Ontario in 2011;

- The conduct of numerous, targeted AIS Rapid Response actions (e.g., "Operation Silver Screen" in the CAWS, round goby eradication effort in Pefferlaw Creek, Ontario);

- IJC's selection of AIS as one of its "nearshore priorities", and the subsequent formation of a Work Group on AIS Rapid Response that has promoted a binational rapid response protocol through commissioned studies;

- Renegotiation of the GLWQA focusing, in part, on enhancing attention to binational AIS prevention and control;

- The U.S. federal Great Lakes Restoration Strategy (and associated funding via the GLRI) highlighting AIS as a linchpin of overall ecosystem restoration efforts; and

- State-specific planning initiatives (e.g., Michigan's Hydrilla Rapid Response Plan and current AIS rapid response planning initiative).

The above examples are evidence of an increased focus on AIS rapid response. With few exceptions, however, these initiatives consist primarily of jurisdiction, lake and/or species-specific planning exercises (at the domestic level) that are best characterized as broad frameworks rather than detailed operational guidance. *At present, a binational protocol capable of rapidly mobilizing agencies, resources and species-specific treatment techniques (in the Lake Huron/ Lake Erie Corridor or at the Great Lakes-St. Lawrence River Basin level) is not available.*

III. JURISDICTIONAL ROLES, AUTHORITIES AND CAPABILITIES FOR RAPID RESPONSE

A. The Institutional Setting for Rapid Response: An Overview

As noted in the preceding section, the last two decades have seen substantial progress in AIS prevention and control efforts, as evidenced by the continued development of jurisdiction and species-specific AIS management plans, prevention-oriented education/ outreach programs, applied research, and technological advancement. *Despite progress to date, however a cohesive and well-coordinated protocol for promptly and efficiently responding to newly documented AIS infestations in the binational waters of the Great Lakes-St. Lawrence River Basin is lacking.* Generally speaking, this unmet need is attributable to three primary challenges:

- *Scientific:* The sheer number of AIS in the system (over 185 documented to date), coupled with limited knowledge of the biology, behavior and ecosystem impacts of most species, introduces a high degree of scientific uncertainty into the development of rapid response protocols. Other factors include a limited understanding of interactions among AIS; difficulties in detecting many species; and added uncertainties associated with the magnitude, complexity and dynamic nature of the basin ecosystem.

- *Policy:* Policy makers at all levels of government are continuously challenged by the need to prioritize issues; determine appropriate legislative, policy and program responses; and allocate limited resources and funds. A resultant pre-disposition toward "crisis response", coupled with competing priorities in an era of fiscal constraints, has also argued against a significant investment in rapid response planning- particularly at the basin-wide level.

- *Institutional:* As previously noted, public agencies are characteristically hesitant to engage in any initiative (within their jurisdiction or basin-wide) in the absence of a clear legislative directive or funded mandate. Institutional "leadership" is also unclear; many agencies (at various levels of government) have assumed a role/ responsibility for some aspect of the AIS issue, but leadership on rapid response is not well-defined- particularly at the binational level. Institutional concerns also include resource limitations (i.e., staffing, equipment, budget, skill sets); real or perceived limitation of authority in addressing an interjurisdictional issue; prospective liability associated with an AIS response action; and the political capital and investment required to develop and maintain a rapid response capability. Beyond these challenges is the formidable task of "harmonizing" inconsistencies in legislation, policies and programs from one jurisdiction to the next.

These challenges aside, recent years have seen a greatly heightened profile for AIS issues and, in particular, the need for a rapid response mechanism as a "fall back" for ongoing prevention and control measures. This development suggests an increasingly favorable climate for (and greater receptivity to) the development of a Binational AIS Rapid Response Plan.

B. The Mechanics of Rapid Response: Institutional Requirements

Previous research commissioned by the IJC Work Group on AIS Rapid Response generated a series of "critical success factors" to guide the development of a protocol for binational AIS rapid response ("Toward a Binational Aquatic Invasive Species Rapid Response Policy Framework", 2009). Drawn from a literature review, a series of personal interviews and species-specific case studies, these factors addressed institutional requirements such as achieving/ sustaining support for plan development and implementation; building upon existing resources; developing inventories to facilitate rapid response actions; organizational considerations; pre-planning to expedite rapid response actions; research and development requirements; establishing the scope of a Binational AIS Rapid Response Plan; ensuring efficiency and effectiveness; and public involvement/ participation.

That exercise yielded a series (i.e., checklist) of desirable structural and operational characteristics that create "an environment for success" in the design and implementation of a Binational AIS Rapid Response Plan. As noted in that document, these desirable *structural*

characteristics include, among others, a designated lead agency(ies) with requisite authority(ies); a planning jurisdiction defined by hydrologic boundaries; well-defined roles for all relevant parties spelled out in pre-incident agreements; clear lines of authority and accountability; monitoring, early detection and rapid scientific assessment components; and adequate (and equitably allocated) funding support for both program maintenance and incident-specific activities.

Desired *operational* characteristics for a binational rapid response plan include, among others, pre-approved Standard Operating Procedures (SOPs) and "on-the shelf" treatment methodologies (e.g., chemical, biological, mechanical); risk assessment methodologies to characterize and prioritize AIS threats; continuous coordination with, and communication among relevant parties; ongoing plan adaptation and training to accommodate evolving needs and new technology; and the cultivation/ maintenance of support from political leadership and the general public.

C. Prospective Participants in Rapid Response: A Descriptive Inventory

The institutional setting for AIS rapid response in the binational Great Lakes-St. Lawrence River Basin is characterized by a range of public and non-governmental entities with a current/ prospective role or interest in AIS, as well as the various related laws, agreements, policies and programs.

Presented below is a descriptive inventory of these various entities, sequentially organized by category (i.e., binational and international entities; Canadian federal, provincial, regional and municipal; U.S. federal, state, regional and municipal; Native American Tribes/ First Nations; and "other" including business/ industry, user groups, citizen organizations, academia and research/ policy institutes). The summary description is complemented by Table 2 (at the end of this section), presenting information on each entity's current/ prospective capability for AIS rapid response. *While a range of entities are identified and described, a primary focus is placed on those with a current or prospective role in AIS rapid response specific to the Lake Huron/ Lake Erie Corridor.*

1. Binational and International Entities

As noted in previous analysis by the IJC Work Group ("Toward a Binational Aquatic Invasive Species Rapid Response Policy Framework", 2009), numerous public entities operating at the binational level are actively addressing AIS issues in some manner, including planning, policy research and development, interjurisdictional coordination, rapid response execution; and/or advocacy (e.g., legislation, programs, funding). Principal entities, which also include quasi-binational and multi-national agencies/ organizations are as follows:

<u>International Joint Commission</u>

The *International Joint Commission (IJC)* has investigative, recommendatory and quasi-judicial authority associated with transboundary environmental issues under the International Boundary Waters Treaty of 1909, and an interest in advancing AIS prevention and control efforts consistent with the GLWQA, as amended.

Comprised of three U.S. and three Canadian Commissioners, the IJC was initially established to resolve disputes between the U.S. and Canada under the aforementioned Treaty, but has since played a larger role in Great Lakes regulation and research. In 1999, the IJC released a white paper entitled "Policies for the Prevention of the Invasion of the Great Lakes by Exotic Organisms". The paper emphasized the need to prevent invasive species introductions through ballast water, and also noted that other major vectors should be controlled (e.g., aquaculture, bait transportation, aquarium trade). More recently and, as noted earlier in this report, the IJC has established a Work Group on Aquatic Invasive Species Rapid Response that has been exploring the scientific, policy and governance dimensions of AIS on a binational level. The IJC was also consulted by the Parties during the recent renegotiation of the GLWQA, an effort that yielded (among others) a new annex calling for a binational approach to AIS prevention, control and rapid response.

Prospective Role and Capacity to Assist in AIS Rapid Response: To date, the IJC role in AIS rapid response has been primarily that of a convener, facilitator, advocate and science-based resource. Through its "nearshore priority" focus and the work of its multiple boards, the IJC has recognized AIS issues as leading threats to ecosystem integrity in the binational Great Lakes-St. Lawrence River Basin. While the IJC does not have experience or explicit authority as a lead entity in executing AIS rapid response actions, it can be expected to play a key partnership/ support role in any such action. As a largely volunteer entity with a core staff of scientists, it has capacity to "ramp up" its scientific support services for a rapid response action. In addition, as a treaty-based entity with a strong relationship with the U.S. Department of State (DOS) and the Canada Department Foreign Affairs and International Trade (DFAIT), the IJC has the ability to access substantial federal resources.

Great Lakes Fishery Commission

The *Great Lakes Fishery Commission (GLFC)* maintains multiple programs to promote the health of the of the Great Lakes fishery, including control of the sea lamprey population, consistent with the 1954 Convention on Great Lakes Fisheries. Comprised of four U.S. and four Canadian Commissioners (and one U.S. Alternate Commissioner), the GLFC has two major responsibilities: 1) develop coordinated research programs in the interest of maximizing sustained productivity of stocks of fish of common concern; and 2) formulate and implement a program to eradicate or minimize sea lamprey populations. The GLFC's Council of Great Lakes Fisheries Agencies is a binational consortium (i.e., federal, state, provincial and tribal representatives) that serves as "keeper" of the Joint Strategic Plan for Management of Great Lakes Fisheries, with responsibilities in the areas of accountability, implementation, periodic review, and guidance/ support to the plan's institutional arrangements. In cooperation with DFO, the U.S. Fish and Wildlife Service (USFWS) and USACE, GLFC participates in sea lamprey control efforts through the plan.

The GLFC is presently engaged in facilitating a major, binational initiative to assess the risk that Asian carps pose to the Great Lakes. The first binational effort of its kind, the study will gauge potential ecosystem effects of the species. The assessment will involve preeminent scientists in the field, will be peer-reviewed, and is scheduled for completion in 2013.

Prospective Role and Capacity to Assist in AIS Rapid Response: The GLFC has decades of experience in leading and coordinating the execution of AIS treatment programs for the sea

lamprey. As a binational, convention-based entity, it also provides a binational forum for fishery managers and other scientists to address threats and opportunities associated with the fishery of the Great Lakes-St. Lawrence River Basin. While its focus has historically been primarily on the sea lamprey, recent years have seen a broadened focus on the AIS threat (particularly Asian carps), and a collaborative working relationship with the IJC, among others. Provided that it receives explicit direction from the two federal governments and, subject to adequate resources, the GLFC has a prospective central role in coordinating AIS rapid response actions, particularly through its Council of Great Lakes Fisheries Agencies.

Great Lakes Commission

The *Great Lakes Commission (GLC)* is an interstate compact agency established in 1955 via the Great Lakes Basin Compact. The GLC carries out policy research, advocacy, coordination and communication functions promoting to promote the "orderly, efficient and balanced development use and conservation" of the Great Lakes. With members from the eight Great Lakes states (as well as associate members from Ontario and Quebec), the GLC is the primary forum for these jurisdictions to develop collaborative policy approaches regarding the environmental and economic dimensions of the binational Great Lakes-St. Lawrence River Basin.

The GLC promotes a consistent, coordinated and integrated approach to a range of issues affecting the binational system, including AIS. In 1991, the GLC established the Great Lakes Panel on Aquatic Nuisance Species in response to Section 1203 of the U.S. federal Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990. In addition to staffing that entity, GLC maintains an active AIS prevention and control program (including policy research and development, coordination and advocacy) under the authority of the Compact. The GLC has overseen numerous projects on a wide range of AIS concerns, including AIS in trade, phragmites control, early detection and monitoring, model GIS assessment, facilitation of statewide management plans, and development of a model rapid response plan. In addition, the GLC recently co-sponsored (with the Great Lakes St. Lawrence Cities Initiative- GLSLCI) a major study examining alternatives for hydrologically separating the Great Lakes and Mississippi Basins in the interest of preventing or minimizing the likelihood of AIS accessing the Great Lakes system.

Prospective Role and Capacity to Assist in AIS Rapid Response: Through the Great Lakes Panel on Aquatic Nuisance Species, the GLC has assumed a central role in heightening the profile of AIS issues at the binational level. Key roles have included harmonizing AIS-related multi-jurisdictional laws, policies, programs and plans; identifying research needs; developing templates for AIS management plans and (primarily state) laws; and compiling/ maintaining a list of priority AIS species. The GLC has no experience or authority for executing rapid response actions, but can serve in important support roles via interjurisdictional coordination, and as a resource on existing state and provincial level AIS management plans and jurisdictional authorities and capabilities.

Council of Great Lakes Governors

The *Council of Great Lakes Governors (CGLG)* was established in 1982 as a private, non-profit association of the six western-most governors in the Great Lakes region. Over time, its

membership has grown to include the governors of the eight Great Lakes states, with associated membership for the premiers of Ontario and Quebec. The CGLG advocates and promotes regional policies, programs and initiatives entailing environmental protection/ restoration and economic development, including an active interest in AIS prevention and control needs. The CGLG was actively involved in developing and advancing the Great Lakes Regional Collaboration (described later in this section) and its focus (among others) on AIS prevention and control.

Prospective Role and Capacity to Assist in AIS Rapid Response: CGLG involvement in AIS issues has focused primarily at the policy level, with an emphasis on coordinating and vocalizing the response of the region's governors and premiers to AIS issues. A prospective role for CGLG in AIS rapid response could be to ensure that the resources of their respective states/ provinces are directed, as needed, in the event of a binational rapid response action.

Great Lakes St. Lawrence Cities Initiative

The *Great Lakes St. Lawrence Cities Initiative (GLSLCI)* is a binational coalition of mayors and other senior municipal officials dedicated to protecting and restoring the vitality of the Great Lakes and St. Lawrence River and improving the quality of life for residents of the region. Formed in 2005, GLSLCI provides coordination, policy analysis and advocacy services. Its broad range of interests include AIS prevention and control, as evidenced by its co-sponsorship of the aforementioned study to examine alternatives for hydrologically separating the Mississippi and Great Lakes Basins as an AIS prevention and control measure.

Prospective Role and Capacity to Assist in AIS Rapid Response: GLSLCI has been an active and vocal advocate for enhanced municipal-level involvement in key decisions and actions to advance the environmental health and economic well-being of the Great Lakes-St. Lawrence River Basin and its residents. Local level involvement in a rapid response action is typically extensive, and can include items such as securing staging areas, providing site security for treatment areas, protecting water intakes and other vital infrastructure, and providing support staff and local labor for rapid response actions. Given this, GLSLCI can support the rapid response effort by heightening the profile of AIS rapid response at the municipal level, and securing the active involvement of municipal officials in the planning process.

Great Lakes Regional Collaboration

The *Great Lakes Regional Collaboration (GLRC)* is a consortium of public agencies and nongovernmental entities formed in response to Presidential Executive Order (EO) 13340 of 2004. The following year, the GLRC authored a "Strategy to Restore and Protect the Great Lakes", featuring AIS prevention and control as one of eight principal themes with an associated implementation strategy identifying action items and lead agencies/ organizations. Primarily a U.S. initiative, the GLRC has maintained a binational focus and invited Canadian participation in its strategy development efforts. That strategy ultimately provided the basis for the GLRI, a large-scale, multi-year funding program that has directed substantial funds to AIS prevention and control efforts.

Prospective Role and Capacity to Assist in AIS Rapid Response: The member agencies and organizations that comprise the GLRC can provide indirect assistance to specific binational

AIS rapid response efforts through continued efforts to highlight AIS prevention and control as a major ecosystem restoration theme. Further, these entities can influence and direct funding (via the GLRI and other sources) to critical areas, including support for both domestic and binational AIS rapid response planning and execution.

Midwest Natural Resources Group

The Midwest Natural Resources Group (MNRG) is comprised of senior executives of 14 federal agencies operating in four major watersheds (i.e., Great Lakes, Ohio, Missouri and Upper Mississippi) that span 12 states. MNRG was formally established in 1998, and provides a forum for senior executives to communicate, coordinate and collaborate on key watershed issues and initiatives. The MNRG produced a 2006 document titled, "Action Plan for Addressing Terrestrial Invasive Species Within the Great Lakes Basin". While the focus, as noted, is on terrestrial as opposed to aquatic species, the coordinative framework established in the plan has relevance to aquatic invaders as well.

Prospective Role and Capacity to Assist in AIS Rapid Response: The MNRG membership includes all federal agencies with a current/ prospective role in AIS rapid response in four major watersheds. As such, it has potential value as a forum to share rapid response experiences and approaches, as well as to identify "best practices" for prospective application.

Remedial Action Plan Organizations- Binational Areas of Concern Program

The St. Clair and the Detroit Rivers are AOCs designated under the GLWQA. Remedial Action Plan (RAPs) are underway for each, at various stages of development/implementation, in accordance with the "Four Agency Commitment Agreement" between the US, Canada, Michigan and Ontario. The St. Clair River RAP is a bi-national undertaking, comprised of numerous federal, state, provincial and municipal agencies, along with industry, user group, citizen and other non-governmental interests. The Friends of the St. Clair River (formerly the Binational Public Advisory Committee) is tasked with coordinating RAP efforts among the various stakeholders.

The Detroit River RAP was once binational, but is now being developed and implemented by two distinct entities. RAP development/ implementation efforts in the Canadian portion of the AOC are coordinated by the Detroit River Canadian Clean-up Committee (DRCCC), with participation from such entities as Environment Canada (EC), Ontario Ministry of the Environment (MOE), MNR, Essex Region Conservation Authority (ERCA), local municipalities, the Essex County Stewardship Network, the University of Windsor's Great Lakes Institute for Environmental Research (GLIER), Citizens Environment Alliance (CEA), local industries, and the Windsor Port Authority. Citizen involvement is carried out through a committee of the DRCCC (i.e., Education and Public Involvement Committee), and through an independent Public Advisory Council. On the U.S. side, the Friends of the Detroit River (FDR) serves as the lead public advisory group, with participants that include USEPA, USFWS, Michigan Department of Environmental Quality (MDEQ), City of Detroit, Metropolitan Affairs Coalition, and Trust for Public Lands, among others.

Prospective Role and Capacity to Assist in AIS Rapid Response: These three RAP groups provide convenient access to numerous agencies and organizations with a specific focus on

ecosystem issues in the Lake Huron/ Lake Erie Corridor. Their individual and collective efforts to address designated BUIs include a concerted focus on fish and habitat-related matters relevant to the design and implementation of a Binational AIS Rapid Response Plan. Thus, they have a potential role in multi-agency/ multi-organizational coordination, public engagement, data and information-sharing, and local assistance with AIS rapid response actions.

Four Agency Management Committee

A Four Agency Management Committee (comprised of Environment Canada- EC, USEPA, MOE and MDEQ) established a framework (under the GLWQA) for binational coordination of Lake St. Clair issues. Components of this framework include a "Binational Partnership Agreement" (i.e., Four Agency Letter of Commitment); a Four Agency Management Committee; a Binational Working Group; local Canadian and U.S. Watershed Coordinating Councils; and a Biennial State of Lake St. Clair Conference. Through these mechanisms, binational coordination, planning, monitoring and related multi-jurisdictional actions are taking place on a range of ecosystem issues.

Prospective Role and Capacity to Assist in AIS Rapid Response: As with the above-mentioned RAP organizations, institutional arrangements associated with the Four Agency Management Committee include a range of entities that can potentially assist with some aspect of AIS rapid response support, whether it be multi-agency/ multi-organizational coordination, public engagement, data and information-sharing, or local assistance with AIS rapid response actions.

International Maritime Organization

The *International Maritime Organization (IMO)* is the United Nations' specialized agency responsible for safety and security of shipping and the prevention of marine pollution by ships. Programs include maritime safety, maritime security, marine environment, legal affairs, human element facilitation, and technical co-operation. The IMO maintains a concerted focus on AIS prevention and control, adopting (in 2004) the "International Convention for the Control and Management of Ships' Ballast Water and Sediments". The convention defines a ballast water treatment standard and will come into force when at least 30 countries, accounting for at least 35% of the gross tonnage of the world's merchant shipping, have ratified it. (The U.S. and Canada have yet to do so).

Prospective Role and Capacity to Assist in AIS Rapid Response: IMO's Marine Environment Protection Committee (MEPC) is a driver at the international level for AIS prevention and control via ballast water measures. It has the ability to inform United Nations decisions and international authorities that may influence Canadian and U.S. regulations, guidelines and international shipping affairs. While it would not have an active role in a binational AIS rapid response action, its policy making and standard setting activities may help influence the design and execution of any such action.

International Council for the Exploration of the Sea

The *International Council for the Exploration of the Sea (ICES)* is a 19-member international body focused on management of the North Atlantic and adjacent seas. Its 2003 "Code of

Practice on the Introductions and Transfers of Marine Organisms" recommends procedures and practices to reduce risks from the adverse effects of intentional introductions and transfers of marine and brackish water organisms.

Prospective Role and Capacity to Assist in AIS Rapid Response: Similar to the IMO discussion above, ICES recommendations can help shape U.S. and Canadian policy relative to AIS prevention and control, thereby having an indirect impact on how rapid response measures are designed and executed.

Council for Environmental Cooperation

The *Council for Environmental Cooperation (CEC)* is a trilateral entity (i.e., Canada, United States, Mexico) formed under the "North American Free Trade Agreement" (NAFTA) to investigate and make recommendations pertaining to the environmental implications of NAFTA implementation. The CEC has addressed AIS prevention and control efforts at the urging of its Joint Public Advisory Committee (JPAC). A CEC work group released its "Trinational Risk Assessment Guidelines for Aquatic Alien Invasive Species" at the April 2009 International Conference on Aquatic Invasive Species in Montreal.

Prospective Role and Capacity to Assist in AIS Rapid Response: CEC's work to date, including the aforementioned 2009 guidelines, may help inform the development and application of risk assessment protocols specific to the binational Great Lakes-St. Lawrence River Basin. Such protocols will be needed to develop and refine a list of "high risk" species for the Lake Huron/ Lake Erie Corridor, as well as for site- specific characterization of a detected species to determine whether a rapid response action is warranted.

2. Canadian Governance: Federal, Provincial, Regional and Municipal

In Canada, jurisdiction over environmental concerns and water quality is shared between the federal and provincial governments. The former has jurisdiction over international treaty development and implementation, fisheries, navigation and shipping, defense, and international waterways. The latter has authority over Crown-owned lands and resources including water, property and civil rights, fish and wildlife conservation and management, and local affairs. Issues arising out of overlapping jurisdiction are addressed through consultation processes under the auspices of the Environment Ministers, the Wildlife Ministers, and the Fisheries and Aquaculture Ministers through a Canada-Wide Accord on Environmental Harmonization.

In some instances, provincial authority has been delegated to municipalities and Conservation Authorities (CAs). In Ontario, municipalities and counties operate within a "one-tier" or "two-tier" system. In the former, there is no oversight by another municipal authority. In the latter, local municipalities must coordinate their policies with those of the county, which provides regional services and has approval authority for many local decisions. Also, in the event of overlapping jurisdictional issues, county by-laws typically take precedence (e.g., in planning matters).

A. Federal Government

The Canadian federal framework for AIS prevention and control is complex, characterized by authorities imbedded in numerous laws, and with roles and responsibilities distributed among various agencies. The legislative framework is comprised largely of longstanding laws that have been interpreted and applied to various aspects of AIS. Principal among them is the Canadian Fisheries Act (governing fisheries and aquatic habitat management issues); the Canada Shipping Act of 2001 (establishing, in 2006, a mandatory ballast water management program to minimize the uptake/ discharge of harmful species by commercial vessels); and the Canadian Oceans Act (providing for integrated management of ocean resources, including the fishery). A new Fisheries Act has also been under consideration in the form of Bill C-32, which explicitly addresses AIS issues and provides the authority required to develop prevention and control regulations. Regulatory authorities affecting AIS also include the Canadian Environmental Protection Act (CEPA), as well as the Wild Animal and Plant Protection and Regulation in International and Interprovincial Trade Act. The latter controls the intentional importation of nonindigenous species posing environmental risks.

Progress in AIS prevention and control efforts in Canada is tempered by continuing concerns over readiness to respond to new introductions and threats, as noted in a March 2008 "Status Report of the Commissioner of the Environment and Sustainable Development". Among others, the report states that the DFO "should apply a systematic risk-based approach to early detection and develop the ability to respond rapidly when new invasive species are detected in order to prevent them from becoming established or to control them."

Key Canadian federal agencies associated with AIS prevention and control include the following:

Department of Fisheries and Oceans

The *Department of Fisheries and Oceans (DFO)* is charged with providing for safe and accessible waterways; healthy and productive aquatic ecosystems; and sustainable fisheries and aquaculture. Key priorities for fisheries management in Canada include environmental sustainability, economic viability, and the inclusion of stakeholders in decision-making processes. Guiding legislation includes the Oceans Act and the Fisheries Act. The Department is also one of the three responsible authorities under the Species at Risk Act (SARA) which protects many aquatic species (e.g., fish, reptiles, marine mammals, mollusks).

DFO is the designated lead federal agency for AIS prevention and control efforts but, depending upon species involved and associated pathways into Canadian waters, AIS management can also involve EC, Transport Canada, Industry Canada, the Canadian Food Inspection Agency (CFIA), the Canadian Border Services Agency (CBSA) and/ or Heath Canada, among others.

In the Great Lakes-St. Lawrence River Basin, DFO has a particularly significant role through the Canadian Coast Guard (CCG), which is primarily responsible for addressing AIS introductions via the ballast water of ocean-going commercial vessels. The CCG is a "Special Operating Agency" of the Department and, within the Corridor, bases are located in Amherstburg and Sarnia, ON. The CCG maintains several programs including Marine

Communications and Traffic Services, Search and Rescue, Boating Safety, Environmental Spill Response, Aids to Navigation, Navigable Waters Protection, and Ice Breaking. Relevant statutes under which the DFO and the Coast Guard operate are the Fisheries Act, the Canada Shipping Act (CSA), and the SARA (for aquatic species).

DFO provides research, monitoring, and sea lamprey control functions as the Canadian lead agency for the GLFC. DFO has also established a Centre of Expertise for Aquatic Risk Assessment (CEARA) which, in 2006, drafted national risk assessment guidelines. CEARA's goals include establishing national standards and guidance for conducting biological risk assessment, building an expert network, educating practitioners, developing a process to prioritize risk assessment needs, and coordinating the tracking of risk assessments.

Working with other federal departments and with the Canadian Council of Fisheries and Aquaculture Ministers (CCFAM), DFO led the adoption of "A Canadian Action Plan to Address the Threat of Aquatic Invasive Species". The Action Plan addresses the unauthorized introduction or transfer of AIS into Canadian waters, including the Great Lakes. Authorized introductions and transfers are regulated pursuant to the National Code on Introductions and Transfers of Aquatic Organisms, adopted in 2001, and implemented primarily by the provinces. The Action Plan focuses on seven key pathways for AIS introductions and makes a series of recommendations on reviewing and implementing changes in legislation, risk management (i.e., risk assessment, early detection and rapid response), science (i.e., monitoring, research and risk analysis) and engaging Canadians (i.e., stewardship, education and awareness).

The DFO completed a "National Framework for Rapid Response" in 2010, and has initiated a comprehensive, basin-wide, bi-national Asian carp risk assessment. Also, DFO has appointed an Invasions Biology Research Chair at the University of Windsor to undertake further research into AIS vectors and impacts.

DFO's Arctic and Central Region is based in Sarnia, ON. Research on the conservation and sustainable development of Canada's fishery resources and aquatic ecosystems is conducted at the Great Lakes Laboratory for Fisheries and Aquatic Science at the Canada Centre for Inland Waters (CCIW), in Burlington, Ontario.

Prospective Role and Capacity to Assist in AIS Rapid Response: As noted above, DFO is the lead Canadian federal agency for the prevention and control of AIS, and is extensively involved in all facets of planning, policy making, research, risk assessment and AIS treatment programs. As such, it is expected to have a leadership role for Canada in binational AIS rapid response efforts, working in collaboration with other key federal, provincial, regional and municipal entities. Significantly, DFO is the primary repository for equipment, chemicals and related material stockpiled for rapid response actions.

Environment Canada

The *Environment Canada (EC)* mission is to preserve and enhance the quality of Canada's natural environment and resources, with a strong emphasis on research, scientific monitoring, policy and regulatory activities. The Ontario Region office, responsible for the Lake Huron/ Lake Erie Corridor, is located in Toronto. Within EC, the Canadian Wildlife Service (CWS)-

Ontario Region is responsible for species at risk, habitat conservation (including wetlands), and monitoring the health of ecosystems and wildlife species. Among others, EC derives its authority from CEPA, which protects the environment from pollution, as well as the Canada Wildlife Act (CWA), the Canada Water Act (CWA), Water Governance and Legislation, SARA, and the Environmental Enforcement Act (EEA).

EC has a primary responsibility for Canada-United States initiatives under the GLWQA and, as such, is extensively involved in AIS prevention and control activities. The agency led development of a national "Invasive Alien Species Strategy" in 2004 and, with support from CFIA and DFO, administered an Invasive Alien Species Partnership Program (IASPP) that provided provinces, municipalities and non-governmental organizations with $l.0M (CA) annually over a five year period to support the strategy. EC is also the lead agency for providing funds for restoration projects in **AO**Cs through the Great Lakes Sustainability Fund.

Prospective Role and Capacity to Assist in AIS Rapid Response: EC has been a key Canadian federal partner in AIS prevention and control efforts, with a particular emphasis on research, monitoring, environmental protection and policy/ regulatory development. As such, it can be expected to provide primary scientific support in both the development and execution of AIS rapid response actions at the binational level.

Canadian Council of Fisheries and Aquaculture Ministers

The *Canadian Council of Fisheries and Aquaculture Ministers (CCFAM),* comprised of federal, provincial and territorial officials, established an Aquatic Invasive Species Task Group (2002) that produced (with EC leadership) the aforementioned 2004 "Invasive Alien Species Strategy." The strategy calls for a multi-faceted approach entailing prevention, early detection, rapid response planning, containing/ controlling established and spreading species, and reviewing/ reporting on the effectiveness of measures. The strategy also provided the basis for the Task Group's subsequent development of the "Canadian Action Plan to Address the Threat of Aquatic Invasive Species". The plan is providing national guidance and promoting consistency among provinces, as is a "National Code on Introductions and Transfers of Aquatic Organisms", developed under the auspices of the CCFAM in 2003 by DFO and the various provinces/ territories. The code outlines a standard risk assessment process for intentional introductions for the purposes of aquaculture and fish stocking.

Prospective Role and Capacity to Assist in AIS Rapid Response: In addition to providing a valuable coordinative mechanism at the interjurisdictional level, the aforementioned CCFAM products (i.e., Strategy, Action Plan, National Code) will inform the development and execution of AIS rapid response actions specific to the binational Great Lakes-St. Lawrence River Basin. CCFAM does not provide on-site rapid response services, but it's "up front" guidance will enhance the efficiency of any such action.

Health Canada

Health Canada is dedicated to ensuring the health of the nation's citizens. Under the authority of the Pest Control Products Act (PCPA), the agency stringently regulates pesticides to ensure they pose minimal risk to human health and the environment. Health Canada also provides information on pest control and the proper use of pesticides, and maintains a Public Registry.

In addition, Health Canada registers and provides permits for pesticide application. Health Canada partners closely with other federal departments, provinces and territories to test ways in which the Canadian health care system can be improved and ensure its sustainability for the future.

Prospective Role and Capacity to Assist in AIS Rapid Response: Health Canada is responsible for pesticide regulation in Canada and, as a result, will have a critically important role in any decision regarding chemical control of AIS. The agency will need to work with other AIS rapid response partners on a proactive basis to ensure that rapid responders have the necessary permits for (and timely access to) chemical controls.

Natural Resources Canada

Natural Resources Canada (NRC) is dedicated to improving the quality of life of Canadians by creating a sustainable resource advantage. The agency is responsible for the development and protection of natural resources under federal jurisdiction, and for coordinating actions with DFO and EC. The agency's regulatory authority is founded in laws that include CEPA and the Department of Natural Resources Act. NRC was the coordinating entity for development of the "National Invasive Alien Species Strategy" called for by federal, provincial and territorial ministers responsible for wildlife, forests, fisheries and aquaculture. Associated with this Strategy is the "Lake Superior Aquatic Invasive Species Complete Prevention Plan", a binational initiative to prevent new AIS from becoming established in the Lake Superior ecosystem. It provides key recommended actions to be taken by both the U.S. and Canada and presents a list of AIS vectors and pathways addressed by the plan.

NRC also provided funding for the construction of a building for the development and operation of a joint federal-provincial Invasive Species Centre (ISC) in Sault Ste. Marie, Ontario. The ISC conducts research and coordinates efforts to check the spread of terrestrial and aquatic invasive species.

Prospective Role and Capacity to Assist in AIS Rapid Response: Along with DFO and EC, NRC has been a key Canadian federal partner in AIS prevention and control efforts. As noted above, NRC coordinated federal multi-agency input into the "National Alien Invasive Species Strategy." In addition, its leadership on the binational Lake Superior prevention plan (also referenced above) suggests the agency's "value added" in AIS rapid response planning at the binational level. While the agency's AIS mission does not include a lead role on executing rapid response plans, it can offer substantial strategic and scientific support in both the development and execution of AIS rapid response actions at the binational level.

Transport Canada

Transport Canada (TC) is responsible for developing and administering policies, regulations and programs directed at protecting the marine environment; reducing the adverse impacts of marine pollution incidents; and promoting the safety of the general public. The agency's Environmental Protection Division, along with the Canadian Marine Advisory Committee (CMAC) plays a key role in AIS prevention and control efforts. Also, TC is a member of the Canadian delegation at the IMO Marine Environmental Protection Committee. Within the agency's responsibilities are the Canadian Ballast Water Program, Marine Policy and

Environmental Affairs, Emergency Management Act (EMA), Canada Marine Act (CMA), Canada Transportation Act (CTA), CSA and CEPA.

In the interest of protecting navigable waters, TC has established an Environmental Response System through which policies, regulations and programs to prepare for and respond to spills and other environmental emergencies are developed and administered. Port Authorities, including the Port of Windsor in the Lake Huron/ Lake Erie Corridor, operate under the CMA and work in coordination with TC to carry out its National Marine Policy.

Prospective Role and Capacity to Assist in AIS Rapid Response: In addition to its environmental protection role (e.g., ballast management, marine spills), TC has considerable expertise in emergency response planning and implementation. Further, any AIS rapid response action in the Lake Huron/ Lake Erie Corridor is likely to have some implications for commercial navigation and, thus, will require TC involvement.

Agriculture and Agri-Food Canada

Agriculture and Agri-Food Canada (AAFC) maintains an Agri-Environment Services Branch with four programs of potential relevance to AIS prevention and control: 1) Healthy and Diverse Ecosystems (i.e., a focus on productive resilient, diverse ecosystems); 2) Viable Populations of Species (i.e., native Canadian species and species at risk); 3) Genetic Resources and Adaptive Potential (i.e., new food varieties, pharmaceuticals, bioenergy, resistance to pests and disease); and 4) Sustainable Use of Biological Resources (i.e., healthy, prosperous communities, sustainable livelihoods, lifestyles).

AAFC scientists study invasive species that affect agriculture and are working with other government departments to develop control strategies. Research into biodiversity and taxonomy helps in early detection of invasive species. The Governor in Council may assign other powers and duties to the Minister and may also make regulations for implementing Article 708 of the "Canada-United States Free Trade Agreement".

Prospective Role and Capacity to Assist in AIS Rapid Response: AAFC scientific capabilities have potential value at the preventive level (e.g., research and risk assessment) as well as at the early detection level (e.g., species identification and characterization). These contributions may help facilitate a determination as to whether a rapid response action is warranted.

Parks Canada

Parks Canada acts under the authority of the Canada National Parks Act (NPA) to provide and protect nationally significant examples of Canada's natural and cultural heritage; ensure their ecological and commemorative integrity; and foster public understanding, appreciation and enjoyment. Parks Canada is involved in terrestrial AIS prevention and control efforts nationwide (e.g., Fort Rodd National Historic Site of Canada, Banff National Park of Canada, Gros Morne National Park of Canada). Experience in AIS data collection includes examination of plant records to identify sensitive sites; gauge the threat of specific introduced plants; and development of a list of priority sites for active management within its Vegetation Management Plan. Parks Canada manages five national parks within Ontario, including Bruce Peninsula, Georgian Bay Islands, Point Pelee, Pukaskwa and St. Lawrence Islands.

Prospective Role and Capacity to Assist in AIS Rapid Response: While none of Canada's national parks are physically located within the Lake Huron/ Lake Erie Corridor, three of the five noted above (all but Pukaskwa and St. Lawrence Islands) are located with the larger Lake Huron and Lake Erie Basins. AIS-related data gathering and management efforts at those locations can contribute to the knowledge base that can inform, at least indirectly, binational AIS rapid response efforts within the Corridor.

Canadian Border Services Agency

The *Canadian Border Services Agency (CBSA)* mission is to ensure national security and prosperity by managing the movement of people and goods to and from Canada. CBSA provides integrated border services that support national security and public safety priorities and facilitate the free flow of persons and goods, including animals and plants that meet all federal requirements. The agency enforces the Health of Animals Act and Plant Protection Act at Canada's ports of entry. It's Food, Plant and Animal Program is specifically targeted at AIS issues, and the CBSA has the primary role of preventing, detecting, responding to and managing risks associated with the movement of invasive alien species. Other legislative acts associated with this role include the Agriculture and Agri-Food Administrative Monetary Penalties Act; Canada Agricultural Products Act; Criminal Code; Customs Act; Customs Tariff; Feeds Act; Fertilizers Act; Fish Inspection Act; Food and Drugs Act; Health of Animals Act; Meat Inspection Act; Plant Protection Act; and Seeds Act.

Prospective Role and Capacity to Assist in AIS Rapid Response: The cross-border transport of AIS (either intentional or unintentional) constitutes an increasingly significant pathway that merits further attention. Recent years, for example, have seen numerous incidents of the attempted cross-border transport of live Asian carps. CBSA preventive actions (i.e., inspection services) will, therefore, be a critical adjunct to any AIS rapid response plan at the binational level.

Canadian Food Inspection Agency

The *Canadian Food Inspection Agency (CFIA)* safeguards food, animals and plants to enhance the health and well-being of Canada's people, environment and economy. The CFIA protects Canadians from preventable health risks; provides a fair and effective food, animal and plant regulatory regime that supports competitive domestic and international markets; and sustains the plant and animal resource base. The CFIA sets policies and regulations for plant and animal importations that are enforced by CBSA at Canadian entry points. An important part of inspection includes examining for invasive insects and seeds. CFIA derives its authority under the Plant Protection Act, Plant Protection Regulations, Seeds Act, Seeds Regulations, and Weeds Seeds Order, 2005.

CFIA agrologists, biologists and inspectors visit commercial nurseries, lumber mills, grain storage facilities, farms, public parks and other locations to carry out inspections and conduct surveys for pests. If a new alien pest is found, they impose quarantine and other control measures to restrict spread or eradicate the pest. They also inspect and assess imports of plants, plant products and soil to prevent the entry of pests that could affect Canada's plant resource base and market access.

Prospective Role and Capacity to Assist in AIS Rapid Response: The CFIA can provide a valuable service in AIS prevention via policy and regulatory actions to be enforced by the CBSA. Involvement in the "up-front" component of AIS rapid response (i.e., monitoring, inspection and prevention) would be helpful, as would assistance in identifying and characterizing the risk of AIS with a high likelihood of entering the Great Lakes-St. Lawrence River Basin.

B. Provincial Government

Officials from Ontario and Quebec are actively engaged in system-wide AIS prevention and control efforts through mechanisms such as the IJC, the Binational Executive Committee (BEC) chaired by USEPA and EC, the GLFC and the Great Lakes Panel on Aquatic Nuisance Species.

Ontario has developed a "Biodiversity Strategy" that provides broad guidance for protecting Ontario's biodiversity. It identifies invasive species as one of six key threats, calls for strategic plans to be in place 2015, and also calls for continued/ enhanced measures to promote effective management of invasive species via prevention, early detection and rapid response.

In mid-2012, Ontario released the Ontario Invasive Species Strategic Plan (OISSP) under leadership of the Ontario Ministry of Natural Resources (MNR) with participation from three other ministries (i.e., Environment; Agriculture, Food and Rural Affairs; Transportation). Goals include preventing AIS introductions by identifying/ managing high risk pathways (e.g. ballast water, shipping containers, nurseries); placing bans on high risk species (e.g. Asian carp); improving capability to assess risks of invasions; building capability to quarantine where necessary; enhancing early detection capacity (particularly in high risk areas); taking rapid action to eradicate invasive species; limiting the spread/ impact of invasive species that cannot be eradicated; and providing communication and education services. The strategy has provided a framework and context for a range of efforts.

Relevant agencies at the provincial level with a current or prospective capability to support AIS rapid response in the Lake Huron/ Lake Erie Corridor are described below.

<u>Ontario Ministry of Natural Resources</u>

The *Ontario Ministry of Natural Resources (MNR)* is the lead provincial agency for maintaining natural resources in an ecologically sustainable manner. Toward that end, it provides provincial leadership in coordinating and managing AIS programs and projects to prevent the introduction and spread of non-native species into Ontario waters. MNR operates under the authority of the Fish and Wildlife Conservation Act, Ontario Fishery Regulations (consistent with the federal Fisheries Act), the Public Lands Act, the Lakes and Rivers Improvement Act, and the Endangered Species Act, among others. The agency is also guided by the Ontario Biodiversity Strategy and the OISSP, the latter of which focuses on the identification and management of high risk pathways (e.g., ballast water), enhancing early detection capability, initiating rapid response actions, and using communication/ education to raise awareness of AIS threats. In addition to management, regulatory and research functions, MNR maintains an Invading Species Awareness Program (in partnership with the Ontario

Federation of Anglers and Hunters- OFAH) that promotes education and outreach related to AIS and includes a data base of AIS sightings that support those functions.

MNR worked with the federal government (and other provinces and territories) to develop the "Invasive Alien Species Strategy" for Canada, as well as to strengthen legislation and develop effective means of treating ballast water. MNR is the lead agency for development and implementation of the OISSP and also provided provincial leadership for the Pefferlaw Brook Round Goby Eradication Program that took place in 2005. At the binational level, MNR participates actively with entities such as the Great Lakes Panel on Aquatic Nuisance Species, and is also the provincial representative for all GLFC activities. Binational activities have included participation in Operation Silver Screen, and leadership in the development of the "Asian Carp Response Plan" and simulation exercise in 2011.

MNR supports numerous research efforts on AIS prevention and control. It has provided funding for the establishment and operation of the joint federal-provincial Invasive Species Centre ISC), for the establishment of a Research Chair at Algoma University, and for numerous university-based research projects. The agency has developed a number of invasive species control programs addressing specific species (e.g., phragmites in Wasaga Beach Provincial Park and Rondeau Bay); problem areas (e.g., Trent-Severn Waterway, Ottawa River); and vectors (e.g., Hazard Analysis and Critical Control Point Training for the bait industry, prohibition on buying/ selling live invasive fish species). Recently, MNR has led response efforts for water soldier in the Trent-Severn Waterway and European water chestnut in the Ottawa River.

MNR has partnered with user groups, such as the Bait Association of Ontario, the Ontario Invasive Plant Council and recreational boaters to help raise awareness around particular vectors and prevention and early detection. MNR also helped develop (and continues to support) the OFAH Invading Species Awareness Program, which conducts education and outreach activities with user groups, industry, and the public including the identification and reporting of invasives and maintenance of a database of AIS sightings. One of the initiatives the program has is the Invading Species Hit Squad, a program that educates and engages communities (e.g., Windsor) in AIS prevention, monitoring and control activities. The program has advanced early detection monitoring, rapid response, and field management activities.

MNR is actively involved in the RAP process for the two binational AOCs in the Lake Huron/ Lake Erie Corridor (i.e., St. Clair River, Detroit River). Its role includes undertaking research, restoring habitat, and funding the Ontario Stewardship Program that supports local networks that restore and protect natural habitats and resources. In 2010, MNR provided grant funding to the Rural Lambton Stewardship Network for a project on "Managing Invasive Species to Save and Restore Habitat for Species at Risk", based in the St. Clair River Watershed.

Prospective Role and Capacity to Assist in AIS Rapid Response: MNR serves in a key provincial role on many facets of AIS prevention and control, ranging from policy research and development to administering/ participating in AIS eradication and control programs (e.g., round goby, water soldier, water chestnut). In addition, MNR has extensive experience in responding to forest fires, flood events, and other natural hazards/ disasters. As such, MNR can play a leadership role for Ontario in the design and execution of an AIS rapid response plan for the Lake Huron/ Lake Corridor.

Ontario Ministry of the Environment

The *Ministry of the Environment (MOE*) is mandated to provide Ontario citizens with a healthy environment and healthy communities via clean air, water and land. MOE is responsible for establishing policies and standards, monitoring the environment and program development for critical environmental issues. Toward this end, MOE operates numerous programs relating to the protection of water quality, including the Permit to Take Water Program, the Safe Drinking Water Program, the Source Water Protection Program, and the Nutrient Management regulations. The Ministry operates the Provincial Water Quality Monitoring Network, and collects information regarding stream-water quality from over 400 locations across Ontario.

MOE regulates the use of pesticides and issues permits for the use of chlorine to address zebra and quagga mussel impacts (e.g., clogging water intake pipes). MOE is also responsible for monitoring key environmental indicators that can aid in AIS identification. This includes operation of the Ontario Benthos Monitoring Network to analyze indicators of aquatic ecosystem conditions. MOE undertakes fish contaminant monitoring in conjunction with MNR, using the information collected to establish fish consumption advisories for sport fishing in Ontario waterways.

MOE also administers the province's Emergency Management Program, as prescribed by the Emergency Management and Civil Protection Act (EMCP Act) and Regulation 380/04. The program is based on a risk-management approach and consists of a set of activities, measures and plans to manage emergencies and reduce risks through a proactive and coordinated approach. In addition to the EMCP Act, the MOE Emergency Management Program is further supported by multiple laws administered by the Ministry (i.e., Environmental Protection Act, Ontario Water Resources Act, Safe Drinking Water Act, Nutrient Management Act, Environmental Assessment Act, Pesticides Act). MOE relies heavily on legislation to prevent, mitigate and prepare for potential emergencies related to spills and drinking water hazards and other emergencies that may require its intervention.

MOE assisted MNR in drafting the OISSP. As previously noted, the plan supports the national invasive species strategy by focusing on AIS prevention, early detection, rapid response and effective management.

Prospective Role and Capacity to Assist in AIS Rapid Response: MOE can be expected to play a support role in AIS rapid response efforts in the Corridor given (among others) its environmental protection focus, permitting responsibilities for pesticides, and experience with the design and administration of emergency response programs.

Ontario Ministry of Health and Long-term Care

The *Ministry of Health and Long-term Care* provides overall direction and leadership for the province's health system and, among others, administers the health care system, promotes community/ public health and disease prevention, and coordinated emergency response programs. The Ministry supports and assists other governmental agencies, partners and the public in preventing the arrival and spread of invasive species, specifically as related to human health care issues.

Prospective Role and Capacity to Assist in AIS Rapid Response: The Ministry would not be a primary participant in AIS rapid response plan development and execution, but could serve in a limited "support and assist" role when reviewing plan elements for the human health dimension and providing scientific/ human health advice on concerns related to the species or treatment options.

Ontario Ministry of Transportation

The *Ministry of Transportation (MTO)* is focused on moving people and goods in a safe, efficient and sustainable manner, and on supporting a globally competitive economy and a high quality of life. MTO has a lead provincial role in addressing the infrastructure and operational needs of the province's public ports and facilities, including those in the Lake Huron/ Lake Erie Corridor (i.e., Sarnia, Windsor). MTO is also involved in border crossings with the U.S. to the extent it maintains highways leading up the crossings and has an enforcement role for trucks that do not meet Ontario highway safety standards. (Five of the top seven crossings nationwide are in Ontario: Windsor-Detroit, Sarnia-Point Edward, Fort Erie, Queenston-Lewiston, and Thousand Islands.)

Prospective Role and Capacity to Assist in AIS Rapid Response: MTO may have a prospective role/ interest in AIS rapid response, given that pathways for AIS introductions include (among others) the ballast water of commercial vessels and the intentional/ unintentional cross-border movement of AIS. In addition, prospective rapid response actions in the Lake Huron/ Lake Erie Corridor may have implications for waterborne transportation (i.e., during chemical treatments or mechanical measures). Thus, MTO can be expected to provide "support and assist" functions with regard to rapid response plan review and consultation in the design and administration of a rapid response action.

Ontario Ministry of Agriculture, Food and Rural Affairs

The *Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)* serves as a catalyst for promoting a healthy and prosperous Ontario by transforming the agriculture and food sectors, as well as rural communities. OMAFRA's environmental interests relate to agricultural land use, energy, soils and water. It's Great Lakes Program (primarily addressing nutrient run-off and other harmful pollutants of an agricultural origin) operates under the Canada Ontario Agreement (COA), a collaborative interjurisdictional arrangement involving three provincial agencies (MNR, MOE, OMAFRA) and six federal agencies (EC, DFO, AAFC, TC, NRC, Health Canada). The program has focused on harmful pollutants; lake and basin sustainability; and coordination of monitoring, research and information. OMAFRA also supports training, research and information transfer, and provides industry representation for the aquaculture industry (both land-based and open water cage-based).

Prospective Role and Capacity to Assist in AIS Rapid Response: OMAFRA's prospective involvement in AIS rapid response planning and implementation relates primarily to its inspection, research, and monitoring functions specific to the agriculture industry. Its Great Lakes-related efforts may provide some limited assistance in informing planning and response activities in the Lake Huron/ Lake Erie Corridor as they relate to agriculture and aquaculture interests.

Ontario Parks

Ontario Parks resides within MNR and operates under the 2007 Provincial Parks and Conservation Reserves Act, a key initiative that supports Ontario's Biodiversity Strategy and also complements the province's Natural Spaces Program and Greenbelt Act. Primary functions include park planning, policy and management; science education/ outreach; and research (including species at risk). The agency manages some 330 parks province-wide, encompassing approximately nine million hectares and attracting over 10 million visitors per year. Of these, only the Ojibway Prairie Nature Reserve is physically located within the Lake Huron/ Lake Erie Corridor; several others (e.g., Ipperwash, Pinery) are located along the Lake Huron shoreline, but at a considerable distance from the uppermost reach of the study area.

Prospective Role and Capacity to Assist in AIS Rapid Response: Research and monitoring work at Parks Ontario, as related to "species at risk", may help inform the scientific basis of AIS rapid response plan design and execution. Given the limited agency presence within the Corridor, however, the role can be expected to be a very modest one.

Quebec Ministries

While Quebec government agencies will have no direct role in AIS rapid response specific to the Lake Huron/ Lake Erie Corridor, benefits can be realized from some level of cooperation/ interaction, particularly at the planning level. In addition to its own AIS prevention and control initiatives, Quebec is engaged in both national and binational efforts that impact the Great Lakes-St. Lawrence River Basin. The Ministry of Sustainable Development, which promotes the "preservation and sustainable use of biodiversity", maintains programs that include (among many others), a focus on harmful aquatic species. The Ministry prepared a "Strategy and Action Plan on Biological Diversity" (2004-2007) that addresses AIS prevention and control issues. Ministry roles include policy/ program development, permitting, coordination, investigations/ inspections, professional/ technical assistance, emergency response, finding and information/ documentation.

The Quebec Ministry of Natural Resources and Wildlife has broad responsibilities for managing Quebec's animal, plant and aquatic species, and roles that include parks management, fishing/ hunting license administration and law enforcement, forest fire management/ suppression, and endangered species monitoring. Quebec developed a five year "Action Plan for Aquatic Nuisance Species" in 1998 that provided the basis for later AIS prevention and control efforts. This agency, along with the Ministry of Sustainable Development, coordinates with multiple other ministries with a role/ interest in AIS prevention and control (e.g., Agriculture, International Relations, Transport, Industry and Commerce, Social Services, Economic Development).

Prospective Role and Capacity to Assist in AIS Rapid Response: Involvement of these Quebec ministries at a planning or "observer" level will help promote inter-provincial and binational consistency in AIS prevention and control efforts. This is particularly well-advised to the extent that the AIS rapid response plan for the Lake Huron/ Lake Erie Corridor serves as a model for similar efforts in other binational waters (e.g., St. Lawrence River).

C. Regional

Regional governments of relevance in the Ontario portion of the Lake Huron/ Lake Erie Corridor include CAs, counties and Local Public Health Units. Each is briefly described below.

Conservation Authorities

Ontario features a network of 36 Conservation Authorities (CAs); local watershed-based agencies that deliver programs and services that protect and manage water and related natural resources in partnership with government, landowners and other organizations. Established under the Conservation Authorities Act of 1946, CAs are founded on the principles of local initiative, cost sharing among governmental jurisdictions, and a watershed-based approach to management. In Ontario, CAs have a mandate to address planning and regulation of a number of water related issues, including flooding, shoreline erosion and protection, habitat restoration, source water protection, public education and land stewardship. They are also actively engaged in clean-up and stewardship functions associated with the Great Lakes AOC program; two such binational AOCs (i.e., St. Clair River, Detroit River) are located in the Lake Huron/ Lake Erie Corridor.

Four CAs are within the Lake Huron/ Lake Erie Corridor and include the St. Clair Region, Upper Thames River, Lower Thames Valley, and Essex Region Conservation Authorities. A brief description follows:

The *St. Clair Region Conservation Authority* has jurisdiction over the Sydenham River and 13 smaller sub-watersheds draining into southern Lake Huron, the St. Clair River, and the northeastern portion of Lake St. Clair. Areas of focus include flooding and erosion, land stewardship, forests, wildlife, habitat creation and outdoor recreation. The CA is an active partner in Lake St. Clair planning and stewardship activities. It conducts benthic community monitoring and water quality monitoring in the watershed and monitors species at risk in the Sydenham River, which contains rare communities of freshwater mussels. It also maintains programs to promote awareness of invasive species issues. One important initiative relates to "Invasive Plant Awareness" and the promotion of native species in terrestrial and water gardening.

The *Upper Thames River Conservation Authority*, as the name implies, has jurisdiction over the upper watershed of the Thames River, and encompasses some 1,344 square miles (3,481 km^2) and a population of approximately 485,000. This area is primarily rural with the exception of the urban centers of London, Stratford and Woodstock. While the CA boundaries are well upstream of the Lake St. Clair and the "open waters" of the Lake Huron/ Lake Erie Corridor, the CA's role is potentially significant given that the Thames River is among the most biologically diverse rivers in Canada, a major tributary to Lake St. Clair, and a designated Canadian "Heritage River." Among others, programs and services include environmental planning, watershed planning and environmental monitoring. The CA is actively engaged in AIS prevention and control efforts, with a current focus on zebra mussels as well as non-native plants and insects.

The *Lower Thames Valley Conservation Authority* has jurisdiction over the sub-watersheds of all streams draining into the Thames River from Delaware, ON to Lake St. Clair, as well as watersheds of many streams draining into northwestern Lake Erie. Encompassing 1,264 square miles (3,274 km^2), it is home to approximately 107,000 residents and 10 municipalities. Areas of focus include flood control, land use policy and regulations, forests and habitat, conservation advisory services, parks and education. The CA's "forest and habitats" emphasis includes a focus on invasive species.

The *Essex Region Conservation Authority (ERCA)* has jurisdiction over a substantial portion of the Canadian shoreline in the Lake Huron/ Lake Erie Corridor, including 23 sub-watersheds that drain into southern Lake St. Clair, the Detroit River and the north shore of Lake Erie. Encompassing approximately 715 square miles (1,851 km^2), ERCA's geographic jurisdiction includes approximately 389,000 residents. The CA has nine members including the City of Windsor, County of Essex and the Township of Pelee Island. Managing over 4,000 acres (1,619 hectares) of parkland and some 19 conservation areas, areas of focus include watershed planning and management, drinking water source protection, forestry and tree planting, water quality monitoring, species at risk, conservation and habitat restoration.

Prospective Role and Capacity to Assist in AIS Rapid Response: CAs within the Lake Huron/ Lake Erie Corridor have demonstrated their effectiveness in organizing and focusing multiple local jurisdictions on resource issues of shared concern. Other services (e.g., watershed-based planning, management, monitoring, education/outreach, natural hazard/ disaster emergency response), coupled with a longstanding involvement in binational AOC and related planning efforts, suggest the "value-added" they CAs provide to AIS rapid response planning and implementation. CAs have a strong field presence and extensive knowledge of the watershed, and have technical staff that, in some cases, will be capable of playing a significant role in implementing a rapid response exercise.

Counties

Ontario counties within the pilot area include Lambton (bordering the St. Clair River and portions of Lake Huron); Kent (bordering Lake St. Clair); and Essex (bordering Lake St. Clair. The Detroit River and Lake Erie).

Lambton County government is organized into seven divisions, with the most relevant being Infrastructure and Development. That division includes a Public Works Department and a Planning and Development Services Department. Among others, the latter is responsible for county emergency planning, administration of management plans for county-owned natural areas departments, and Emerald Ash Borer control programs.

The County of Kent and the City of Chatham were amalgamated (in 1998) to form the single-tier *Municipality of Chatham- Kent.* Governance includes eight departments, of which two (i.e., Fire and Emergency Service, Infrastructure and Engineering) are relevant to this pilot study. The former is responsible for maintaining the municipal emergency response plan and emergency operations center, as well as for ensuring ongoing public awareness of emergency response issues. The latter is organized into multiple divisions addressing public works, engineering, transportation, drainage, waste management and related functions.

Essex County government is organized into 14 departments, with relevant ones including Engineering and Planning/Emergency Planning. As an upper-tier municipality, the county provides a range of services common to all seven lower tier municipalities. This includes Planning Services and Emergency Management Coordination.

Prospective Role and Capacity to Assist in AIS Rapid Response: The county within which a prospective AIS rapid response action may take place can provide valuable support services given its ability to grant access to staging areas, as well as its familiarity with local conditions and resources. As noted above, all three counties have some form of emergency response function and, while that function is not specific to AIS, it suggests an ability to support the organization and mobilization of resources.

Local Public Health Units

Local Public Health Units are established and operate under the Public Health Promotion and Protection Act. Functions include sampling water quality at beaches to determine whether they are safe for swimming. Three Public Health Units operate in the corridor: Lambton (in Point Edward), Chatham-Kent (in Chatham), and Windsor-Essex (in Windsor).

Prospective Role and Capacity to Assist in AIS Rapid Response: The mission of these entities is specific to human health and, consequently, their direct relevance to AIS rapid response planning and implementation is limited. However, they can serve in a valuable support role as a repository of water quality data, a reference source relative to the characteristics of local water resources, and a point of inquiry to determine the human health implications (if any) of an existing or prospective AIS. The latter would include advice on such matters as bacteria levels, blue-green algae, and other issues that impair water for drinking or render it unsuitable for recreation purposes such as swimming.

D. Municipal/ Local Government

Within Ontario, municipalities include various local government forms (i.e., cities, counties, regional municipalities, towns, townships, villages) that provide a range of public services. "Single-tier" municipalities are unitary authorities with broad responsibilities for providing all public services. In addition, counties (or regional municipalities) can share responsibility for providing services with constituent entities that include towns, cities, townships, and villages. The former are typically referred to as "upper-tier" municipalities, and the latter as "lower-tier" municipalities.

In the Lake Huron/ Lake Erie Corridor, major "single-tier" municipalities include the Cities of Sarnia and Windsor, and the Municipality of Chatham-Kent. Also within the corridor, as noted above, are two counties (i.e., Lambton, Essex) with jurisdiction over planning and selected environmental issues. Under both systems, authority is exercised under the Municipal Act of 2001 (which authorizes activities related to environmental protection), and the Planning Act (which authorizes restrictions on land use). Dozens of "lower-tier" municipalities are located within the corridor.

The *Great Lakes St. Lawrence Cities Initiative (GLSLCI)*, a binational coalition of mayors and other senior municipal officials from riparian and communities in the Great Lakes-St.

Lawrence River Basin, has a pronounced interest in AIS prevention and control, and can serve in a valuable coordinative, educational and advocacy role.

Prospective Role and Capacity to Assist in AIS Rapid Response: The statement (presented above) relative to county government is also applicable at the municipal level. Local municipalities within which a prospective AIS rapid response action may take place can support the effort given familiarity with, and access to the impacted water resources. Any AIS rapid response action will be well-served by the presence of such local expertise, whether it be at the CA, county and/or municipal level.

3. United States Governance: Federal, State, Regional and Municipal

As in Canada, environmental protection and resource management authority in the U.S. is shared among multiple levels of government (i.e., federal, state, regional, local) and, while individual entities have specific responsibilities and lead roles, interjurisdictional partnerships are key to effective governance. Generally speaking, the federal government has principal authority over navigable waterways, international relations, inter-state commerce and transportation, while the states have lead roles in terms of natural resources, lands and waters within their boundaries, fish and wildlife and local matters. Similarly, sub-state entities (e.g., counties, municipalities, regional councils of government) have significant roles, much of it delegated to the local level by state and/or federal agencies.

A. Federal Government

Federal legislation targeted specifically at AIS introductions in the Great Lakes-St. Lawrence River Basin was first passed in 1990 via NANPCA (Public Law 101-646). Passage of the act was prompted by the unintentional introduction of the zebra mussel into the Great Lakes system in the mid-1980s. The legislation focused on five areas: preventing unintentional introductions; coordinating research, control and information dissemination activities; developing and implementing environmentally sound control methods; minimizing ecological and economic impacts of AIS introductions; and establishing a research program to enhance state-level control efforts. Among others, it established regulatory requirements to prevent AIS introductions to the Great Lakes-St. Lawrence River Basin via the ballast water of ocean-going vessels; established a national, multi-agency Aquatic Nuisance Species Task Force (ANSTF); called for development of comprehensive state management plans; and provided for development of an Aquatic Nuisance Species Program focused on the development and implementation of prevention, detection, monitoring and control programs.

NANPCA was reauthorized in 1996 through the National Invasive Species Act (NISA, Public Law 104-332), which amended the original legislation by expanding the ballast management program to all U.S. coastal regions; authorizing a Ballast Technology Development Program; and providing additional emphasis on region-specific research needs.

An EO signed by President Clinton in 1996 further heightened the national profile of AIS issues by requiring all relevant federal agencies to use existing programs and authorities to address AIS introductions; establishing a federal interagency Invasive Species Council (ISC) to implement EO provisions; and calling for development of an Invasive Species Management

Plan to guide federal efforts via performance-oriented goals and objectives and success measures.

In 2007, NISA was reauthorized with passage of the National Aquatic Invasive Species Act (NAISA, Public Law 110-288). In addition to strengthening the National Ballast Water Management Program and calling for an analysis of other introduction pathways and associated research, NAISA explicitly addresses rapid response issues. Among others, Title III of the legislation calls for the development of sampling protocols for a national system of ecological surveys for the rapid detection of AIS; the development of model state and regional rapid response contingency strategies; a Rapid Response Fund to assist in strategy implementation; expansion of the existing dispersal barrier program; promulgation of regulations to evaluate treatment methods to ensure "environmental soundness"; and development of a new public and industry outreach program.

Complementing the federal legislation noted above is a series of additional federal laws with an AIS dimension. For example, the Lacey Act of 1900 (and amendments) established a permitting process (via USFWS) that regulates the importation and transport of vertebrates, mollusks and crustaceans that are "injurious to human beings, to the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States." The Endangered Species Act (ESA) of 1973 (and amendments) is a vehicle that can be used to authorize AIS eradication or control if there is a threat to a listed species. In addition, EO 13112 in 1999 established the National Invasive Species Council (NISC) and tasked it with the development of a National Invasive Species Management Plan.

Aquatic Nuisance Species Task Force

The *Aquatic Nuisance Species Task Force (ANSTF)* was established under Section 1201 of NANPCA, and is co-chaired by the USFWS and NOAA. Membership includes six federal agencies (ultimately expanded to 10 under NANPCA provisions) and 12 ex-officio members. As outlined in Section 1202 of NANPCA, the ANSTF role is to prevent further unintentional introductions of nonindigenous aquatic species; coordinate federally funded research, control efforts and information dissemination; develop and carry out environmentally sound control methods to prevent, monitor and control unintentional introductions; understand and minimize economic and ecological damage; and establish a program of research and technology development to assist state governments.

Prospective Role and Capacity to Assist in AIS Rapid Response: Direct relevance to AIS rapid response in the pilot area is limited, given that the ANSTF is a U.S. entity with policy and coordinative functions that do not include site-specific rapid response actions. However, current and prospective products of the ANSTF (e.g., AIS management plan templates, rapid response guidance, AIS research on control methods) provide response entities with a valuable reference source and ready access to federal and state expertise.

National Invasive Species Council

Complementing the work of the ANSTF is the *National Invasive Species Council (NISC)*, established via EO 13112 in 1999 as an interdepartmental body that coordinates the invasive species initiatives of over a dozen federal departments. Co-chaired by the secretaries of

Agriculture, Commerce and the Interior, NISC also works closely with an Invasive Species Advisory Council (ISAC) that was instrumental in assisting with the development of the NISC Management Plan. The NISC mission is broad, focusing on both aquatic and terrestrial invasive species nation-wide.

Prospective Role and Capacity to Assist in AIS Rapid Response: The focus of these two entities is on developing policy; coordinating interjurisdictional activities; ensuring consistency in invasive species laws, policies and programs; and promoting/ facilitating the development of state-level invasive species prevention and control programs. As such, their work will benefit AIS rapid response efforts in the Lake Huron/ Lake Erie Corridor, given the interjurisdictional nature of the issue and the expected involvement of many of the federal and state agencies associated with the ANSTF and/ or NISC.

A summary of the roles and responsibilities of selected U.S. federal agencies follows, accompanied by a brief assessment of their prospective role and capacity to assist in AIS rapid response in the pilot area.

U.S. Fish and Wildlife Service

The *U.S. Fish and Wildlife Service (USFWS)* serves as co-chair of the ANSTF and provides a suite of AIS- related services in areas that include planning, coordination, promulgation/enforcement of regulations, research, scientific support, monitoring and early detection, and rapid response. At the national level, the USFWS is responsible for administration of the Lacey Act, which prohibits importation of specified AIS. The USFWS also provides assistance for controlling ANS on federal lands, including 93M acres (37.6M hectares) of wildlife refuges and 25M acres (10.1M hectares) controlled by the Department of Defense (USFWS, 2011). Within the Great Lakes-St. Lawrence River Basin, USFWS is a key partner in the GLFC's sea lamprey control efforts, with responsibility to implement that control program in U.S. waters of the Great Lakes.

Prospective Role and Capacity to Assist in AIS Rapid Response: The USFWS has assumed a federal leadership role in the Great Lakes-St. Lawrence River Basin for AIS prevention and control efforts, and is involved (to varying degrees based on program element and jurisdiction) in facets of planning, policy making, research, risk assessment and AIS treatment programs. Its longstanding role as the U.S. implementing agency for GLFC sea lamprey control efforts has demonstrated its "on the ground" capabilities for executing eradication/ control programs. As such, it is well-positioned to assume a key role, when requested by one or more states, in AIS rapid response efforts. This will include working in collaboration with other agencies and organizations in support of state-led AIS rapid response actions. Also, the USFWS is the primary U.S. federal repository for equipment, chemicals and related material stockpiled for rapid response actions.

U.S. Geological Survey

The *U.S. Geological Survey (USGS)* role in AIS prevention and control is focused primarily on early detection/ assessment of newly established species; research to improve understanding of the ecology of new AIS and habitat resistance to invaders; and monitoring activities to support its AIS detection and research efforts. At the national level, the USGS facility in Gainesville,

FL administers a Nonindigenous Fish Program that entails field and laboratory studies, as well as a Nonindigenous Aquatic Species Program that maintains an AIS database (USGS, 2011). In addition, the agency's Nonindigenous Plants and Animals programs entail monitoring introduced aquatic organisms and providing data for further research and management. The USGS Great Lakes Science Center in Ann Arbor, MI maintains a strong focus on AIS issues in the Great Lakes-St. Lawrence River Basin, and works closely with federal and state agencies on prevention and control efforts.

Prospective Role and Capacity to Assist in AIS Rapid Response: USGS has been a key U.S. federal partner in AIS prevention and control efforts, with a particular emphasis on early detection, risk assessment, research, monitoring, and scientific support to other entities with AIS prevention and control responsibilities. As such, it can be expected to provide primary scientific support in both the development and execution of AIS rapid response actions at the binational level.

National Oceanic and Atmospheric Administration

The *National Oceanic and Atmospheric Administration (NOAA)* is mandated to control and manage AIS under NANPA, a responsibility it shares with the USFWS and other U.S. federal agencies. NOAA's programs include those that target pathogens and parasites of shellfish and threats to fish habitats. The Restoration Center within the National Marine Fisheries Service (NMFS) targets restoration of coastal and estuarine habitats in the interest of developing the science and transferring it to public and private enterprises. NOAA's National Sea Grant Program, which operates in all eight Great Lakes states, conducts research on methods to reduce the impact of AIS, and also undertakes education and outreach programs focused on AIS prevention and control. In addition, the NOAA National Center for Research on Aquatic Invasive Species (NCRAIS) fosters, coordinates and supports development of AIS research.

NOAA's Great Lakes Environmental Research Laboratory (GLERL), based in Ann Arbor, MI, maintains an extensive research program focused on the physical environment, water quantity, water quality, human health, fish recruitment and productivity, and invasive species. GLERL has documented Great Lakes AIS through GLANSIS and has also developed a Great Lakes Coastal Forecasting System (GLCFS).

Prospective Role and Capacity to Assist in AIS Rapid Response: NOAA has, and will continue to serve as a primary federal provider of scientific support services for "on the ground" AIS rapid response activities. Its AIS-specific monitoring, research and assessment functions are complemented by a broader role in understanding the physical characteristics of the Great Lakes-St. Lawrence River Basin. The latter is critical to the design and execution of rapid response actions in a complex, varied system such as that found in the Lake Huron/ Lake Erie Corridor. In addition, the contribution of the Great Lakes Sea Grant Program to AIS-related research, education and outreach has been substantial and, specifically, the Michigan Sea Grant Program can be a valuable addition to rapid response efforts in the Corridor, particularly with regard to on-scene scientific advice and public education/outreach.

U.S. Army Corps of Engineers

The *U.S. Army Corps of Engineers (USACE)* engages in a range of resource planning, management and engineering functions associated with uses/ issues that include (among others) commercial navigation, water-based recreation, flood risk management, storm damage reduction, emergency response, hydroelectric power, water supply shoreline restoration, fish and wildlife conservation, and environmental protection. The USACE Great Lakes and Ohio River Division, located in Cincinnati, OH, performs these and related functions via seven districts that cover approximately 335,000 square miles (867,650 km^2) and 17 states.

The USACE role in AIS prevention and control has increased substantially in recent years as a component of its ecosystem restoration and environmental protection functions. USACE is directly engaged in AIS eradication and control efforts, serving as a member of the Asian Carp Regional Coordinating Committee (ACRCC) and supporting its efforts via operation of the electric dispersal barriers in the Chicago Sanitary and Ship Canal; studying the effectiveness of the barriers and strengthening them, as appropriate; participating in monitoring and research (e.g., eDNA) efforts in the canal; and conducting the Great Lakes and Mississippi River Interbasin Study (GLMRIS). The latter is a multi-year, partnership-based effort (under Section 3061(d) of the Water Resources Development Act of 2007) to explore options and technologies for prospective application in preventing AIS transfer via the two basins. In addition to these activities, USACE receives substantial pass-through funding from the GLRI and presently has multiple reconnaissance studies, feasibility studies and related initiatives underway with an AIS prevention and control component.

Prospective Role and Capacity to Assist in AIS Rapid Response: USACE has a substantial prospective role in AIS rapid response, given its on-the-ground emergency response capabilities, presence in the Corridor, scientific and engineering capabilities, and an established role in AIS specific prevention and control efforts (e.g., electric dispersal barrier management, eDNA monitoring, GLMRIS).

U.S. Coast Guard

Housed within the U.S. Department of Homeland Security (DHS), the *U.S. Coast Guard (USCG)* has a multi-dimensional mission that includes developing and maintaining standards, regulations and guidelines for industry, states and the public relative to implementation of marine protection laws and treaties. A member of the ANSTF, the USCG has primary responsibility for promulgating and administering a mandatory Ballast Water Management Program under NANPCA authority to prevent/ limit AIS introductions to the Great Lakes-St. Lawrence River System. In 1998, the USCG introduced voluntary ballast management guidelines for ships entering the Great Lakes; these guidelines became mandatory in 2004 for all vessels equipped with ballast tanks that enter or operate within U.S. waters. Ships are mandated to exchange ballast water at sea, to retain ballast water on the vessel or to use an alternative approved method, consistent with regulations as published in 33 CFR Part 151; Subpart C.

Prospective Role and Capacity to Assist in AIS Rapid Response: In addition to its AIS-responsibilities (e.g., ballast management), the USGS brings substantial expertise in emergency planning and execution to AIS rapid response efforts. Among others, the agency has primary

federal responsibility for responding to oil and other hazardous spills on the open waters of the Great Lakes-St. Lawrence River System. In partnership with the CCG, the agency also has primary responsibility for CANUSLAK, the "Great Lakes Operational Supplement" to the Joint Marine Pollution Contingency Plan. Referenced in Annex 9 of the GLWQA, the purpose of the Plan is to "provide for coordinated and integrated response to pollution incidents in the Great Lakes System by responsible federal, state, provincial and local agencies." In addition, given that any AIS rapid response action in the Lake Huron/ Lake Erie Corridor is likely to have some implications for commercial navigation, a primary role for the USCG will be required.

U.S. Environmental Protection Agency

The *U.S. Environmental Protection Agency (USEPA)* role in AIS prevention and control is derived from authorities found in multiple federal laws. The Clean Water Act (CWA) directs USEPA to control and manage invasive species through permits and other requirements. Under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), USEPA has regulatory authority over certification of pest control products, and also has review authority of biopesticides used in the control of invasive species. USEPA also administers the National Environmental Policy Act (NEPA) which can, in some instances, require an environmental assessment for AIS control activities. Also, in 2005, USEPA developed a guide to AIS rapid response and control actions to assist natural resources managers in developing AIS rapid response and management plans. This includes guidance on how to apply for CWA Section 404 permits to discharge dredged or fill material, FIFRA Section 18 emergency exemptions, and FIFRA Section 24(c) special local need registrations.

USEPA is actively engaged in Great Lakes AIS research, monitoring, risk assessment and rapid response planning and execution efforts. A 2008 study ("Predicting Future Introductions of Nonindigenous Species to the Great Lakes") examined 14 high risk species (selected from a literature review that identified 156 high risk species). The study highlighted the importance of using ballast water (or other vectors) and selected habitat data to accurately predict high risk invasion areas and species (EPA, 2008).

USEPA is the lead federal agency for coordinating the implementation of the GLWQA, which (in its recently renegotiated form) includes an annex with commitments of both federal governments to coordinate AIS activities on a binational basis. The agency's Great Lakes National Program Office (GLNPO) is the coordinating agency for the Great Lakes Restoration Initiative (GLRI) through an Interagency Task Force and its Regional Working Group. USEPA was actively involved in the Asian carp eradication effort in the CAWS (i.e., Operation Silver Screen), and has been actively promoting (via table-top and filed exercises) the adoption of the ICS model for rapid response.

Prospective Role and Capacity to Assist in AIS Rapid Response: USEPA has been a key U.S. federal partner in AIS prevention and control efforts, with a particular emphasis on research, monitoring, scientific support, environmental protection and policy/ regulatory development. GLNPO, in particular, has been actively engaged in advancing AIS planning and coordination efforts (including rapid response) at the federal, state and binational levels. Given the agency's role in binational Great Lakes matters, as well as language in the recently renegotiated GLWQA that elevates the importance and profile of AIS rapid response planning and

execution, USEPA can be expected to provide scientific and policy support in both the development and execution of binational AIS rapid response actions.

Animal and Plant Health Inspection Service

Housed within the U.S. Department of Agriculture (USDA), the *Animal and Plant Health Inspection Service (APHIS)* is the lead U.S. federal agency for the prevention, control and elimination of animal and plant diseases, with authorities derived from the Federal Plant Pest Act, the Plant Quarantine Act and other related statutes. APHIS has responsibility for importation, interstate movement, and management of AIS. Its AIS role is focused on agriculture, with a primary interest in animal and plant pests, pathogens and noxious weeds.
USDA maintains other relevant programs, such as Natural Resource Conservation Service (NRCS), the Cooperative State Research, Education and Extension Service, and the Farm Services Agency (FSA). These entities work to promote, conserve, improve and sustain natural resources and the environment in coordination with affected communities, federal and local agencies, and others.

Prospective Role and Capacity to Assist in AIS Rapid Response: APHIS can provide a valuable service in AIS prevention and control, given its authority to regulate the importation and interstate movement of AIS. While its primary focus is on agriculture (and associated animal/plant pests, pathogens and noxious weeds), APHIS has considerable experience in rapid response planning and execution; experience that can be brought to bear on planning and execution efforts specific to the Lake Huron/ Lake Erie Corridor. Specifically, involvement in the "up-front" component of AIS rapid response (i.e., monitoring, inspection and prevention) would be helpful, as would assistance in identifying and characterizing the risk of AIS with a high likelihood of entering the Great Lakes-St. Lawrence River Basin.

National Park Service

The *National Park Service (NPS)* has broad regulatory authority (1916 Organic Act) over management of its properties and, in recent years, has used that authority to prepare (in partnership with other entities) rapid response plans for areas threatened by aquatic and terrestrial invasive species. This has included a planning initiative focused on Isle Royale National Park in Lake Superior.

Prospective Role and Capacity to Assist in AIS Rapid Response: While no U.S. national parks are physically located within the Lake Huron/ Lake Erie Corridor, 13 are located within the Great Lakes-St. Lawrence River Basin. AIS-related data gathering, research and management efforts at those locations can contribute to the knowledge base that can inform, at least indirectly, AIS rapid response efforts within the Corridor. In particular, the AIS Rapid Response Plan recently developed by the Isle Royale National Park can help inform AIS rapid response planning and execution specific to the Corridor.

U.S. Department of Transportation

The *U.S. Department of Transportation (DOT)* mission, as described by the agency, is to "serve the United States by ensuring a fast, safe, efficient, accessible and convenient transportation system that meets our vital national interests and enhances the quality of life of

the American people, today and into the future." Among the many organizations within the DOT structure is the Maritime Administration (MARAD), which promotes the development and maintenance of the U.S. merchant marine and associated intermodal infrastructure and services. Another DOT organization is the Saint Lawrence Seaway Development Corporation (SLSDC), responsible for operating and maintaining the U.S. portion of the Great Lakes St. Lawrence River Navigation System. In partnership with Canada's Saint Lawrence Seaway Authority (SLSA), the SLSDC is responsible for overseeing Seaway operations and safety, vessel inspections, traffic control, and navigation aids. In so doing, the SLSDC collaborates with the USCG and other relevant entities in AIS prevention and control efforts related to inspections of commercial vessels entering the Great Lakes system

Prospective Role and Capacity to Assist in AIS Rapid Response: Prospective AIS rapid response actions in the Lake Huron/ Lake Erie Corridor may have implications for commercial navigation in the event that those actions affect the normal transit of vessels through the waterway. In addition, any rapid response action involving ballast water in such vessels will likely involve, at some level, both MARAD and the SLSDC. Consequently, both entities will likely have some level of interest in rapid response planning for the Corridor, as well as a consultative role should a rapid response action be initiated.

Centers for Disease Control and Prevention

The *Centers for Disease Control and Prevention (CDCP)* is the principal U.S. federal agency for protecting the health and safety of all citizens and providing essential human services including, among others, monitoring non-indigenous infectious diseases. CDCP focuses on both infectious and non-infectious diseases, and performs its mission via decision support; promoting health through partnerships with state health departments and other organizations; and focusing national attention on disease prevention and control.

Prospective Role and Capacity to Assist in AIS Rapid Response: While the CDCP does not directly involve itself in AIS rapid response planning and implementation, it is available as a resource should the current or prospective presence of AIS in the Lake Huron/ Lake Erie Corridor be suspected of having infectious disease characteristics. In addition, CDCP is a valuable resource for the development of rapid response protocols, as it is a repository of information on human health-related rapid response actions.

B. State Government

Similar to their provincial counterparts, the eight Great Lakes states are actively engaged in system-wide AIS prevention and control efforts through mechanisms such as the IJC, the BEC, the GLFC and the Great Lakes Panel on Aquatic Nuisance Species. In addition, they have substantial responsibilities for AIS prevention and control within their individual jurisdictions, including planning; promulgation/enforcement of laws and regulations; research; monitoring; detection; rapid response; and education/ outreach.

Many state AIS programs and initiatives respond to (and are shaped by) federal law and regulatory requirements. Consistent with Section 1204 of the NANPCA 1990, the states have prepared and maintain Comprehensive State Aquatic Nuisance Species Management Plans. The legislation calls upon each state to "…identify those areas or activities within the state,

other than those related to public facilities, for which technical and financial assistance is needed to eliminate or reduce the environmental, public health and safety risks associated with aquatic nuisance species." State plans identify prevention and control management practices and measures and, as required, input on their development and implementation is solicited from a range of state, regional and local public agencies and nongovernmental entities. As noted earlier, state activities in all aspects of AIS prevention and control are coordinated through the Great Lakes Panel on Aquatic Nuisance Species, as authorized in NANPCA 1990. Among others, Panel activities (and products) are directed at promoting consistency at the interstate, interagency and binational level with respect to AIS prevention and control planning, rapid response, research, policy development, legislative/ regulatory development, and education/outreach. Among others, Panel products relevant to AIS rapid response planning and execution in the Lake Huron/ Lake Erie Corridor include model state management plans, a model rapid response plan, and a continuously updated listing of "priority" AIS in the Great Lakes-St. Lawrence River Basin.

In Michigan, several departments (i.e., Natural Resources, Environmental Quality, Agriculture and Rural Development) share responsibility for AIS policy, legislation, regulation, education, monitoring, assessment, management and control. In the event of a newly identified AIS in Michigan waters, the departments will work together to identify a lead agency depending on the taxa of concern and the location of the AIS.

Michigan employs the ICS for large scale issues that threaten public health and well-being (e.g., forest fires, oil spills). There may be instances where a formal ICS structure is necessary for AIS rapid response (e.g., release of live Asian carp due to a spill from a truck, large and complex application of rotenone or other chemical). For other scenarios that require strategic action and coordination to assess the situation, Michigan uses elements of ICS (e.g., established "command groups").

Presented below is a summary description of state (i.e., Michigan) agencies that are expected to have a direct role in AIS rapid response planning and execution specific to the Lake Huron/ Lake Erie Corridor. It should be recognized, however, that much can be learned from the rapid response initiatives of other states. Forums such as the Great Lakes Panel on Aquatic Nuisance Species are ideally suited for information sharing and technology transfer, and could also serve as a coordination vehicle when marshaling region-wide resources for an AIS rapid response action with Basin-wide implications.

<u>Michigan Department of Natural Resources</u>

The *Michigan Department of Natural Resources (MDNR)* is responsible for conserving, protecting and managing the use and enjoyment of the state's natural resources. Toward that end, the department has a special focus on fisheries; wildlife; parks and recreation; forest, mineral and fire management; land and facilities; and law enforcement. The agency's Wildlife and Fisheries Divisions are actively engaged in resource management efforts in the Lake Huron/ Lake Erie Corridor, and also support related binational efforts specific to Lake St. Clair and Lakes Huron and Erie. Phragmites control is a continuing priority of the department which, more generally, has been involved in early detection/ rapid response for invasive plant species. The agency has also played a key role in Asian carp prevention and control initiative, as evidenced by the Fisheries Division role in preparation of the "Proposed Plan for the

Prevention, Detection, Assessment, and Management of Asian Carps in Michigan Waters" (December 2010, updated in 2012). The MDNR Wildlife Division is currently developing an AIS early detection and rapid response plan for with a focus on aquatic invasive plants.

Prospective Role and Capacity to Assist in AIS Rapid Response: Given its fish and wildlife management responsibilities, as well as its continuing role in AIS prevention and control, MDNR can be expected to play a leadership role for Michigan in the design and execution of an AIS rapid response plan for the Lake Huron/ Lake Erie Corridor. This role will need to be closely coordinated with the MDEQ.

Michigan Department of Environmental Quality

The *Michigan Department of Environmental Quality (MDEQ)* is responsible for protecting and sustaining the health of the state's citizens and natural resources. Multiple divisions within the agency (e.g., Water Resources, Remediation and Redevelopment, Office of Environmental Assistance) have key environmental protection/ resource management functions within the Corridor. MDEQ's Water Resources Division is responsible for coordinating the update and implementation of Michigan's Aquatic Invasive Species State Management Plan, which includes strategic actions to prevent new AIS, limit the spread of AIS, detect and rapidly respond to new invaders, and manage and control existing AIS. The update and implementation of the Plan is a cooperative effort between the Michigan Departments of Environmental Quality, Natural Resources, Agriculture and Rural Development, and Transportation. The Water Resources Division is also responsible for chairing and coordinating Michigan's Aquatic Invasive Species Advisory Council, which is tasked with making recommendations on a range of AIS-related issues.

MDEQ also houses the Office of the Great Lakes (OGL), which has lead responsibility for the state's role in the development of interjurisdictional policies, programs and initiatives affecting the water and related natural resources of the Great Lakes-St. Lawrence River Basin. OGL is a primary point of contact for many regional Great Lakes entities. The OGL also has experience in developing a response plan for the invasive plant *Hydrilla.*

Prospective Role and Capacity to Assist in AIS Rapid Response: As noted above, MDEQ has key environmental protection/ resource management functions, including pesticide permitting responsibilities in aquatic environments within the Corridor. Thus, MDEQ can be expected to have a key coordinative role for state involvement in plan development and implementation, and draw from the expertise and resources at other departments such as MDNR.

Michigan Department of Agriculture and Rural Development

The Michigan Department of Agriculture and Rural Development (MDARD) protects the food, agricultural, environmental, and economic interests of the citizens of Michigan. Among its 10 divisions are Emergency Preparedness (to prevent/ facilitate statewide responses to food and agriculture-related disasters); Environmental Stewardship (focusing on conservation/ development of soil and water resources); and Pesticides and Plant Pest Management (implementing programs/ enforcing laws concerning agricultural products, export commodities, pesticide sale/use, pest management; and groundwater protection).

MDARD, along with MDEQ and MDNR, serves as a partner in the update and implementation of Michigan's AIS State Management Plan. MDARD also serves on the Michigan Invasive Species Plant Council and has had extensive involvement, among others, in purple loosestrife prevention and control efforts.

Prospective Role and Capacity to Assist in AIS Rapid Response: Significant MDARD involvement in AIS rapid response planning can be expected, particularly with regard to invasive aquatic plants. The agency's longstanding partnership with MDNR and MDEQ on AIS issues, as well as its emergency response capability, is also indicative of the prospective value it adds to rapid response efforts in the Lake Huron/ Lake Erie Corridor. Its contributions to planning efforts are complemented by a prospective "support and assist" role in plan implementation.

Michigan Department of Community Health

The *Michigan Department of Community Health (MDCH)* is responsible for protecting, preserving and promoting the health and safety of Michigan citizens and, as such, is responsible for establishing and implementing health policy for the state's publicly-funded health service systems. Among its numerous units is the Office of Public Health Preparedness, which protects the health of citizens before, during and after public health emergencies such as natural and man-made disasters, acts of bioterrorism, and infectious disease outbreaks. The Bureau of Disease Control, Prevention, and Epidemiology tracks and investigates the occurrence of communicable diseases. Of particular interest is the agency's Great Lakes Border Health Initiative (GLBHI), a multi-state/ provincial/ tribal/ First Nations collaborative that shares data and information on newly emerging diseases (e.g., SARS, Avian Influenza) to ensure that geopolitical and jurisdictional boundaries do not hinder infectious disease control and surveillance efforts.

Prospective Role and Capacity to Assist in AIS Rapid Response: MDCH can provide vitally important decision support services in the event that an AIS with potential to introduce a communicable disease is detected in the Corridor. In addition, its experience with the GLBHI is directly relevant to the interjurisdictional challenges of a binational AIS rapid response action. Thus, its involvement in planning efforts will be helpful in anticipating/ addressing cross-border issues that may be encountered in an AIS rapid response action.

Michigan Department of Transportation

The *Michigan Department of Transportation (MDOT)* mission statement calls on the agency to provide the "highest quality integrated transportation services for economic benefit and improved quality of life." The agency has direct jurisdiction over the state's highway system and also administers other state and federal transportation programs for aviation, intercity passenger services, rail freight, local public transit services and various other programs including an interest in commercial maritime transportation. Given the transportation dimension of AIS prevention and control, MDOT has had longstanding involvement in the issue, including past and present participation on multiple teams and advisory councils with partner agencies.

Prospective Role and Capacity to Assist in AIS Rapid Response: MDOT will have a role/ interest in AIS rapid response, given that pathways for AIS introductions include (among others) the ballast water of commercial vessels and the intentional/ unintentional cross-border movement of AIS, such as the case with multiple recent incidents involving Asian carps. In addition, prospective rapid response actions in the Lake Huron/ Lake Erie Corridor may have implications for waterborne transportation (i.e., during chemical treatments or mechanical measures). Thus, MDOT can be expected to provide "support and assist" functions with regard to rapid response plan review and consultation in the design and administration of a rapid response action.

C. Regional

Regional governance in the U.S. portion of the Corridor is found at the county, multi-county and watershed level:

- Counties include St. Clair (bordering the St. Clair River and Lake Huron); Macomb (bordering Lake St. Clair); Wayne County (bordering the Detroit River and Lake St. Clair); and Monroe County (bordering the Detroit River and Lake Erie). Non-riparian counties that lie partially within the pilot area (i.e., the Lake Huron/ Lake Erie Corridor drainage) include Oakland and Lapeer Counties.

- At the multi-county level, the Southeast Michigan Council of Governments (SEMCOG) brings together representatives of local governments in seven counties of Southeast Michigan, including those identified above (with the exception of Lapeer County.) in the corridor.

- At the watershed level, several organizations (organized around tributaries to the Corridor) are actively involved in AIS-related issues including, among others, the Clinton River, Huron River and Raisin River Watershed Councils.

The four riparian counties (St. Clair, Macomb, Wayne, Monroe) are briefly described below, followed by SEMCOG and the watershed councils.

Counties

St. Clair County's extensive shoreline includes portions of Lake Huron and Lake St. Clair, as well as the entire length of the St. Clair River. Comprised of approximately 837 square miles (2,168 km^2) of land and water, the county is home to approximately 163,000 residents according to the 2010 U.S. Census. County government is organized into 34 offices, with those of potential relevance being Drain Commissioner, Emergency Management, Environmental Services, Marine Patrol, Parks and Recreation, and Public Health. The Office of Emergency Management maintains a "multi-hazard" plan addressing natural, technological and terrorism incidents, and coordinates all other county offices in response actions. A Local Emergency Planning Committee, under federal legislative authority (Superfund Amendments Reauthorization Act- SARA) coordinates public/ private sector response efforts associated with hazardous substance releases into the air, land and/or water. In addition, the St. Clair County Hazardous Operations Team responds to transportation related spills and is also designated by the State of Michigan as a regional response Team for Weapons of Mass destruction incidents.

Macomb County's boundary includes a significant portion of Lake St. Clair. It encompasses approximately 570 square miles (1,476 km^2) and, with a population of almost 841,000 (2010 U.S. Census), it is among the state's three most populated counties. It is characterized by a highly developed shoreline and intensive residential development. County government includes some 45 different departments and offices, with the most relevant including Health and Community Services; Public Works; Risk Management and Safety; and Emergency Management and Communications. The latter houses the county's Emergency Operations Center charged with responding to natural and man-made disasters. Relevant boards and commissions include the Local Emergency Management Commission (responsible for investigating the potential for hazardous chemical spills and integrating plans into the overall County Emergency Operations Plan), and the Water Quality Board (responsible for advising the Health Services Committee of the Board of Commissioners).

Wayne County boundaries encompass the entire U.S. side of the Detroit River and, in total, include some 672 square miles (1,740 km^2). The most populous county in Michigan (1.82 million residents according to the 2010 U.S. Census), the county is characterized by a heavily developed and industrialized riverfront, along with dense urban and residential development. The Wayne County waterfront also features the Detroit River International Wildlife Refuge (the only designated international wildlife refuge in North America) that includes coastal wetlands, islands, marshland and waterfront parks. The County government includes 11 executive departments, with those of potential relevance being Homeland Security and Emergency Management (maintaining the County's Emergency Management Program and responding to natural and man-made disasters); and Environmental Services (protecting and restoring water resources via a watershed management approach).

Monroe County lies immediately south of Wayne County, with its easternmost boundary lying along the western basin of Lake Erie downstream from the mouth of the Detroit River. Totaling approximately 630 square miles (1,632 km^2) with a population of 152,000 (2010 U.S. Census), the county features diverse shoreline uses including heavy industry, coal and nuclear power plants, port and marina facilities, a portion of the Detroit River International Wildlife Refuge, and Sterling State Park. County government features 26 departments and offices, with the most relevant being Emergency Management (maintaining Emergency Operations and Emergency Communications Centers to respond to natural, technological, national security, nuclear and hazardous material disasters); Environmental Health (environmental monitoring and protection); and Public Health (addressing naturally-occurring agents and diseases as well as biological threats).

Prospective Role and Capacity to Assist in AIS Rapid Response: All county governments have multiple departments/ offices with the potential to assist with AIS rapid response planning and execution. This includes emergency response capabilities for natural and man-made disasters, in-depth knowledge of local water resources, familiarity with local conditions, and the ability to grant access to staging areas. While their emergency response capabilities are not specific to AIS, local personnel are trained in emergency operations and have the general skills needed to support the organization and mobilization of resources.

Southeast Michigan Council of Governments

The Southeast Michigan Council of Governments (SEMCOG) is a seven county regional planning partnership whose members include (among others) the four counties profiled above, along with numerous cities, villages, townships and academic institutions. Its broad functions include regional transportation planning, air and water quality protection, housing and land use planning, and economic development. The restoration and protection of the waters of the Lake Huron/ Lake Erie Corridor is a longstanding priority. Among others, SEMCOG has coordinated development of a "Strategic Implementation Plan for the St. Clair River and Lake St. Clair"; supported the use of technology (i.e., monitoring, modeling and observing systems) as decision support for water resources restoration and protection; and assisted member jurisdictions in grant applications for water resources-related projects.

Prospective Role and Capacity to Assist in AIS Rapid Response: While SEMCOG is not suited to "on the water" execution of AIS rapid response actions, it can provide valuable services through multi-jurisdictional planning and consensus-building, identifying and key county and municipal officials, marshaling resources needed for rapid response actions, and informing/ educating local officials and the general public of AIS issues and impending rapid response actions.

Watershed Councils

Located within the U.S. portion of the Lake Huron/ Lake Erie Corridor are several watershed councils that provide a variety of monitoring, stewardship, education and coordination services directed at the various units of governments within the watershed, as well as citizen/ industry/ user groups and individuals. Formed under the Michigan Local River Management Act (253 P.A. 1954) and generally operated as 501(c)(3) non-profit organizations, they maintain small professional staffs and extensive volunteer networks. Three of particular relevance include:

- The *Clinton River Watershed Council* is dedicated to improving water quality, promoting innovative watershed management techniques, and "celebrating" the river as a natural and recreational resource. Its focus is on a 760 square mile (1,968 km^2) watershed that spans portions of three counties (all adjacent to the Corridor) and includes the 80 mile (129 km) main stem of the Clinton River, along with approximately 1,000 miles (1,609 km) of streams. Services include (among others) water quality monitoring, stormwater education, AOC clean-up efforts, and coordination among the council's many county, municipal and non-governmental members and supporters. The watershed is at the uppermost reach of the U.S. portion of the Corridor.

- The *Huron River Watershed Council* provides watershed science, management, education, stewardship and advocacy services for a watershed that spans more than 900 square miles (2,331 km^2) and includes approximately 125 miles (201 km) of river as well as hundreds of tributary creeks and streams. The watershed includes portion of seven counties, including two that are adjacent to the Corridor (i.e., Wayne and Monroe Counties). It is located in what might be described as the "middle reach" of the U.S. portion of the Corridor.

- The *River Raisin Watershed Council* provides environmental education, water quality monitoring and stream restoration services within the 1,072 square mile (2,276 km^2) watershed, comprised of the 150 mile (241 km) long River Raisin and portions of five counties. Two of those counties (Monroe County, MI and Fulton County, OH) are adjacent to- and comprise the southernmost portion of the U.S. side of the Corridor.

Prospective Role and Capacity to Assist in AIS Rapid Response: While watershed councils do not have the capacity (trained personnel or resources) or mission to provide primary rapid response services, they can provide valuable support functions given their familiarity with local conditions and resources, coordination role with county and municipal officials, and expertise/ existing role in watershed education. These functions will be particularly relevant in the event that AIS are discovered in tributaries to the Lake Huron/ Lake Erie Corridor.

D. Municipal/ Local Government

Within the four Michigan counties adjacent to the open waters of the Corridor are some 70 cities and villages, as well as over 160 townships and unincorporated communities. Many of the larger municipalities (e.g., Port Huron, Detroit, Monroe), as well as mid-sized communities, will have some capacity to assist in rapid response actions.
Municipal officials have a vested interest in AIS prevention and control issues from multiple perspectives, including human health (e.g., beach closures/ advisories due to AIS impacts); safety (e.g., zebra/ quagga mussels obstructing water intakes); ecosystem health (e.g., ecological integrity of area water resources and habitat); and economic development (e.g., viability of sport fishery and other water-based recreation, integrity of public infrastructure). In addition, local levels of government serve an essential prospective role as "first responders" in the detection of AIS and determination of response actions.

As noted earlier, the GLSLCI, as a coordinative entity for many municipalities in the U.S. and Canadian portions of the Corridor, has been actively involved in AIS prevention and control from a coordination, education and advocacy standpoint.

Prospective Role and Capacity to Assist in AIS Rapid Response: The statement (presented above) relative to county government is also applicable at the municipal level. Local municipalities within which a prospective AIS rapid response action may take place can support the effort given familiarity with, and access to the impacted water resources. Any AIS rapid response action will be well served by the assistance of municipal officials.

4. Native American Tribes and First Nations

Aboriginal peoples, including "Tribal Authorities" in the United States and "First Nations" in Canada, have a pronounced interest and role in AIS prevention and control efforts. This role is explicitly identified in basin-wide AIS plans, reports and strategies of entities such as the IJC, GLRC, GLFC and GLC, among others. Tribal Authorities and First Nations representation is found on various AIS-related panels and committees associated with these and other entities.

In the U.S. portion of the Great Lakes-St. Lawrence River Basin, 35 federally-recognized Tribal Authorities retain rights to hunt, fish, and gather in areas ceded to the federal

government via various treaties. As "domestic dependent sovereigns" per U.S. Supreme Court definition, Tribal Authorities retain the right to make and be governed by their own laws, and maintain a range of programs designed to protect and conserve natural resources and the environment. Their "government to government" relationship with federal and state agencies defines their role in AIS prevention and control efforts.

Intertribal agencies in the Great Lakes-St. Lawrence River Basin (i.e., Chippewa Ottawa Resource Authority- CORA; Great Lakes Indian Fish and Wildlife Commission- GLIFWC), are vehicles by which multiple Tribal Authorities coordinate their role on natural resources and environmental issues, including those associated with AIS prevention and control. In addition, a Great Lakes Regional Collaboration Tribal Caucus was established to participate in development of the Collaboration's Great Lakes Restoration Strategy, including a strategy theme devoted to AIS prevention and control.

There are no Tribal lands associated with the U.S. portion of the Lake Huron/ Lake Erie Corridor.

In Canada, First Nations have constitutionally protected status, and the Crown has continuing obligations to consult with and accommodate the interests of First Nations when decisions are made that might affect their traditional rights or lands. Under provisions of the Indian Act, Band Councils are empowered to establish bylaws associated with fish and wildlife protection. Additionally, First Nations operating under the First Nation Land Management Act are empowered to establish their own legal frameworks for land management and environmental protection. Given that provincial legislation is not generally applicable on reserve lands, First Nations participation in intergovernmental AIS prevention and control programs is a key consideration. The "Canadian Action Plan to Address the Threat of Aquatic Invasive Species" speaks to the importance of "maintaining relationships with….Aboriginal peoples" and working with them "…in identifying risks and in making management decisions." It further states that the plan "cannot succeed without the full participations of ...Aboriginal peoples…"

Several First Nations are associated with the Corridor. The Chippewas of Aamjiwnaang occupy a reserve in Sarnia located on the east bank of the St. Clair River. There are 655 aboriginal people living on the reserve and another 808 living off the reserve. The Aamjiwnaang community is in the midst of creating a species at risk inventory and habitat protection program around the St. Clair River.

Bkejwanong, or the Walpole Island First Nation, is a large territory located in the St. Clair River delta, home to 2,180 people, with another 1,210 living off the reserve. Bkejwanong has established the Walpole Island Land Trust, which is undertaking a marsh habitat restoration project, with community partners. The project includes habitat restoration, invasive species (with emphasis on phragmites) control, research and training. The Trust has adopted an "Ecosystem Recovery Strategy", and plans to restore wetlands habitat and reverse the degradation in its water systems caused by drainage alterations and invasive species introductions. It has developed a mapping system for phragmites, as a first step in implementing control measures, and is training community members to conduct environmental and wildlife surveys to help in these efforts.

In addition to the two aforementioned communities, there are several reserves in the Thames River Watershed, including the Caldwell First Nation, the Chippewas of the Thames, the Oneida Nation of the Thames, the Delaware Nation of the Thames, and the Munsee Delaware Nation.

The Anishinabek/Ontario Fisheries Resource Centre (A/OFC) is a non-profit partnership between the Union of Ontario Indians and the Ministry of Natural Resources. A/OFC distributes grants for fisheries management projects in collaboration with 40 First Nations communities that prioritize projects to utilize limited funding. This entity could potentially have a role in AIS prevention and control in the Corridor.

Prospective Role and Capacity to Assist in AIS Rapid Response: Given their presence and legal standing in the Corridor, the First Nations noted above should be consulted/ engaged in both AIS rapid response plan development and execution. While there are no Tribal Authorities physically present in the U.S. portion of the Corridor, entities such as GLIFWC and CORA can add value to the plan development process, given their experience in AIS prevention and control in other portions of the Great Lakes-St. Lawrence River Basin.

5. Other Organizations

Business, Industry and User Groups

Issues associated with AIS introductions and impacts are of substantial concern to a range of business, industry and user groups in the binational Great Lakes-St. Lawrence River Basin. This level of interest and concern is a reflection of the region's water-based economy and the pervasive ecological and economic impacts of AIS. For example, members of maritime commerce organizations (e.g., Lake Carriers Association- LCA, International Association for Great Lakes Ports- IAGLP, American Great Lakes Ports- AGLP, Great Lakes Task Force- GLTF) are directly affected by public policy and regulatory measures, and actively participate in deliberations on AIS prevention and control strategies. Utilities featuring water intakes and discharges (e.g., municipal/ industrial water supply, water treatment, cooling) have been impacted by AIS introductions (e.g., zebra and quagga mussel) and have participated in these deliberations as well. Water-based recreational activities (e.g., recreational boating, sport fishing, beach use) are affected by AIS introductions and associated impacts from various perspectives (e.g., sport fishery health, beach/ water quality, aesthetic considerations). In addition to those mentioned above, user groups affected by/ interested in these impacts include such entities as boating industry associations, water-dependent industries (e.g., Council of Great Lakes Industries- CGLI), hunting and fishing organizations (e.g., OFAH), and cottager associations.

Prospective Role and Capacity to Assist in AIS Rapid Response: Business, industry and user groups are often in a position to partner with public agencies (either on a location-specific or Basin-wide basis) on prevention and control efforts. Among others, this might include promoting practices (e.g., industrial, trade, shipping, recreational fishing, boating) that further such efforts. In addition, certain specialty firms can be called upon, as contractors, to assist public agencies in the design and execution of AIS Rapid response plans.

Citizen Organizations

Numerous non-governmental organizations (NGOs) and citizen groups within the binational Great Lakes- St. Lawrence basin maintain an active interest in AIS issues, with a special focus on advocacy (i.e., laws, regulations, programs, research, funding); education/ outreach; promoting public involvement; and, in some instances, maintaining scientific and policy research programs. Among many others, such groups include Healing Our Waters- Great Lakes Coalition (HOW Coalition); Alliance for the Great Lakes (AGL); Great Lakes United (GLU); The Nature Conservancy (TNC); National Wildlife Federation (NWF) - Great Lakes Natural Resource Center; state and provincial NGOs (e.g., OFAH, Ontario Streams, state environmental councils), state and provincial chapters of national/ international organizations; and many local groups with site-specific interest in AIS issues.

Prospective Role and Capacity to Assist in AIS Rapid Response: Such entities provide information/ education, policy coordination and advisory services associated with the Basin-wide, lake-wide and local-level implications of AIS. In some instances, these entities may be field operational (e.g., OFAH, Ontario Streams, TNC) and in a position to assist with the planning and implementation of a rapid response exercise.

Academia, Research/ Policy Institutes and Inter-agency Consortia

Multiple academic institutions, inter-agency consortia and institutes are actively involved in a range of AIS-related activities, including basic and applied research; policy development/ analysis; outreach/ education programs; monitoring and surveillance; and technical assistance to federal, state and provincial control efforts. NOAA-funded Sea Grant Programs operate in all Great Lakes states and maintain active AIS programs with a special focus on funding research, designing/ conducting education/ outreach programs, and promoting monitoring and early detection. The Smithsonian Environmental Research Center (SERC) houses a Marine Invasions Research Laboratory that maintains a National Ballast Water Information Clearinghouse. Entities such as the Northeast-Midwest Institute (NEMWI) have long maintained applied research and demonstration programs associated with AIS control efforts such as the Great Ships Initiative focused on eliminating/ reducing AIS introductions via ballast water of commercial vessels in overseas trade. At the international level, entities such as the Global Invasive Species Programme (GISP), an initiative of the Scientific Committee on Problems of the Environment (SCOPE), have addressed the issue, with GISP authoring a 1999 report titled, "Invasive Alien Species: A Toolkit of Best Prevention and Management Practices."

At the university level, numerous institutions within (and beyond) the Corridor have engaged in research and field work that has advanced understanding of AIS issues and implications, and provided a decision support system for public officials. The Great Lakes Institute for Environmental Research (GLIER) at the University of Windsor, for example, focuses on complex environmental problems that cross conventional disciplinary boundaries, such as the effects of multiple environmental stressors on large lakes, their watersheds and marine environments. GLIER staff hold Natural Sciences and Engineering Research Council (NSERC) Research Chairs in Great Lakes Research, Trophic Ecology, and Environmental Genomics, as well as a DFO Research Chair in Invasion Biology. Faculty and students at GLIER perform AIS research and update Canadian Aquatic Invasive Species Network (CAISN) information.

The recently (2011) established Invasive Species Centre (ISC) in Sault Ste. Marie, Ontario also has the potential to contribute substantially to the development and implementation of a Binational AIS Rapid Response Plan for the Lake Huron/ Lake Erie Corridor. Located at the NRC's Great Lakes Forestry Centre, the ISC is a non-profit organization representing a multi-million-dollar, joint investment by the governments of Canada and Ontario. The Centre focuses on coordination of research, data management, strategic planning, mitigation and response actions, and rehabilitation efforts for the purpose of combating terrestrial and aquatic alien invasive species that threaten Canada's natural resources and ecosystems.

In 2011, a Memorandum of Understanding was signed by multiple Canadian federal and provincial agencies (i.e., DFO, NRC, CFIA, MNR), outlining the need for greater cooperation and coordination of efforts to address terrestrial and aquatic invasive species issues. To advance this enhanced federal-provincial collaboration, Canada and Ontario established the ISC in April of that year.

During its first year of operation, the ISC worked with partners to advance more than 60 scientific research and strategic project initiatives focusing on aquatic resources, forests, plants, and policy and information. With its emphasis on interagency and non-governmental collaboration, the ISC is viewed as an important part of Canada's and Ontario's efforts in response to invasive species and the ever-increasing threats that they pose from both ecological and socio-economic perspectives.

In addition to GLIER and the ISC, AIS-related research is actively conducted at a multitude of other U.S. and Canadian academic institutions.

Prospective Role and Capacity to Assist in AIS Rapid Response: Academic institutions, as well as the larger array of policy/ research institutes and inter-agency consortia (within and beyond the Corridor), can provide vital decision support services that may include AIS rapid response plan development; basic and applied research on the life cycle of various AIS; invasive pathway analysis; risk assessment studies; monitoring; and the development and testing of alternative chemical, biological and mechanical treatment protocols. The ISC offers a particularly promising forum for advancing binational AIS rapid response initiatives in the Lake Huron/ Lake Erie Corridor (as well as the Great Lakes-St. Lawrence River Basin in general), provided that it embraces a full collaboration with relevant U.S. federal, state, regional and municipal/ local entities.

Professional Associations

AIS prevention and control issues in the Great Lakes-St. Lawrence River Basin have also captured the attention of a number of regional, national and international associations with research and/ or operational interests. The International Association for Great Lakes Research (IAGLR) has long provided a forum for the AIS research community to share basic and applied research findings, as well as report on current and emerging issues associated with the introduction and spread of AIS. The American Water Works Association (AWWA), representing municipalities and other entities involved in water supply/ treatment, has long had a vested interest in AIS prevention and control, given the significant economic impacts associated with infrastructure maintenance and retro-fitting. Entities such as the American and

Canadian Water Resources Associations (AWRA, CWRA), with a diverse membership and network of state/ provincial chapters, have also been actively engaged on the issue.

Prospective Role and Capacity to Assist in AIS Rapid Response: Such associations can raise member awareness of AIS issues and impacts, encourage basic and applied research to inform AIS Rapid response planning and execution, and disseminate research findings.

D. Jurisdictional Capabilities Assessment- An Interview-based Approach Interview

A series of 11 interviews were conducted with AIS resource managers, response practitioners and researchers affiliated with various agencies and academic institutions within the binational Great Lakes-St. Lawrence River Basin. These individuals were selected primarily on the basis of their experience and expertise with rapid response planning initiatives; most have been engaged in the development and/or implementation of species-specific rapid response plans. The interview subjects (see Appendix B) were invited to participate in their "personal and professional" capacities with the understanding that observations and recommendations to be included in this report would be presented without attribution.

The interviews were conducted via telephone and entailed a 60-90 minute conversation guided by a series of (primarily) open-ended questions. Each question is presented below, accompanied by a summary of key responses. A brief analysis of the collective responses then follows.

1. *Based on your own experiences, what problems and challenges might be encountered in the development and/or implementation of a Binational AIS Rapid Response Plan?*

   - It is important to know (to the extent possible) the species most likely to be encountered that will require a rapid response action.
   - The Binational AIS Rapid Response Plan must be sufficiently flexible (and comprehensive) to address variability in terms of different species, chemical treatment options, location-specific considerations, and related matters.
   - A clear understanding of lead and support agency(ies) is essential, along with specific roles and responsibilities. In particular, collaboration at the binational level, where "cultures" (i.e., organizational approaches) may differ, is essential.
   - Ensuring adequate communications among all interested/ affected parties can be challenging, particularly in densely populated areas with multiple-use, water-based activity. A rapid alert mechanism could be effective.
   - Anticipated impacts of rapid response actions on downstream interests must be considered.
   - Assessment of risks relative to rapid response vs. "no action" should be conducted.
   - Avoiding duplication of effort/ inefficiencies is a challenge in complex, binational setting.
   - The presence of threatened and/or endangered species may require special accommodations in the selection and use of various AIS treatments.
   - There are significant differences between Canada and the U.S. relative to treatment preferences, chemical registration, application protocols, regulations, etc. There is a need to resolve these differences when preparing a plan through mechanisms such as a binational or joint chemical registration program.

- Balancing the need for binational cooperation with a respect for sovereignty is a challenge.
- Long-term funding support for personnel, equipment and training must be sustained.
- A "tool kit" of chemical (and other) treatment options must be developed.
- Prevention is as important as rapid response and must be incorporated into any rapid response plan. This should include early detection and monitoring programs
- The question of "who should pay?" must be resolved; consideration should be given to a trust fund or similar mechanism.
- Existing entities such as the GLFC struggle annually with funding for sea lamprey control; this is indicative of the challenges that will be involved in securing larger scale support for AIS rapid response.
- The value of ICS needs to be clearly explained to (and understood by) all interested parties; it can be "scalable"; kept and resolved at the local level and with local responders if circumstances allow.
- An "online" reference source is needed to inform rapid response approaches by identifying important ecological features (e.g., spawning reefs for sturgeon).
- The diverse physical characteristics of the pilot area (e.g., fast flowing river, tributaries, wetlands) will require an array of treatment options.
- Some scientists and resource managers are skeptical about rapid response and prefer to focus exclusively on prevention.
- A substantial investment of time and effort is required to resolve inconsistent/ incompatible regulations among jurisdictions.
- Non-ship vectors must be addressed more aggressively in any prevention and control initiative.
- Political support at the highest levels (including DOS and DFAIT) is needed to establish and maintain momentum.

2. *What opportunities might we take advantage of? For example, are there "success stories" we can learn from, or response protocols in place (at some level) that we can build upon?*

- The ACRCC has evolved into a coordinative entity that may offer a good template.
- The updated State of Michigan "Aquatic Nuisance Species Management Plan" has a rapid response component that will be relevant in formulating a binational plan.
- Michigan's rapid response plan prepared for Hydrilla is relevant.
- We can take advantage of ongoing communications/ coordination among Great Lakes jurisdictions relative to interjurisdictional AIS prevention and control.
- A Canadian rapid response plan is under development and features basic steps: notification, confirmation, investigation of details, establishment of goals/ desired outcomes, development of options, identification of decision makers (built around ICS), execution, monitoring, follow-up, evaluation, and re-initiation of treatment (if needed).
- The long-standing activities of the Great Lakes Panel on Aquatic Nuisance Species have laid the groundwork for cooperation, collaboration and a forum for sharing opinions and addressing conflict.
- The Southeast Michigan Area Committee for oil and hazardous material spill response provides an effective networking mechanism that can be tapped into, along with many other established arrangements in the pilot area (e.g., SEMCOG, AOC Public Advisory Committees).

- Inspections of vessels entering the Great Lake-St. Lawrence River System is a success story in prevention, made possible through the GLWQA, international rules driving the process, and a dedicated effort to tie science to decision making regarding regulations.
- The totality of initiatives in the Great Lakes-St. Lawrence River Basin provide a foundation that can be drawn upon to inform the development of a rapid response plan. The ICS approach should be at the center of plan design given its ability to "make order out of chaos."

3. *What type of plan framework will be most effective at the binational level, and why? For example, might a simple, collaborative agreement facilitating cooperation among various jurisdictions be adequate? Or, are we in need of a single, formal binational plan, founded in law and/or binational agreement, with explicit response strategies coordinated by an oversight body?*

    - Initially, it will be most effective to "start small" and gradually build up to an international agreement with a designated body (existing or new) charged with overall leadership/ coordination authority for rapid response actions. Over time, items to be added to a basic agreement might include specific response options and species-specific response strategies.
    - There is no "cookie cutter" approach; every rapid response incident is unique. Prepare and follow a basic protocol that focuses on chain of command, clear roles and responsibilities, open communication and cooperative effort. Within that "template" a response to specific incidents can be developed and pursued.
    - A detailed structure is needed, and should include an executive decision making body, interjurisdictional agreements, a detailed step-by-step approach organized around ICS, and scientific advisory support.
    - The plan must be a "delicate balance" between the generic and the specific to ensure effective guidance while retaining flexibility. At the minimum, it must convene all relevant AIS experts to identify commonalities among AIS and "group" the various species in such a manner that treatment options can be drawn from a "tool kit".

4. *Are you aware of any Rapid Response plan, program or protocol (addressing AIS or any other issue) that may serve as a good template for this exercise? What "best practices" and "lessons learned" have applicability to a prospective Binational AIS Rapid Response Plan?*

    - The ACRCC may serve as a good template, particularly as it relates to the execution of ICS, determination/ assessment of risk, and identification of desired outcomes.
    - "Table top" and "field" exercises in rapid response are valuable learning tools.
    - The rapid response plan developed to address the round goby problem in Lake Simcoe may have value as a template.
    - An emergency response exercise on the Detroit River, simulating a bomb explosion on board a passenger vessel (with associated oil spill), offers some insights into potential elements of a Binational AIS Rapid Response Plan.
    - Asian carp response plans being developed in both Michigan and Ontario warrant review.

- The GLWQA has been an effective mechanism in addressing the ballast water vector for AIS, and should be considered for a rapid response planning and implementation role.
- The Joint Contingency Plan (CANUSLAK- Annex 9) of the GLWQA is an excellent model.
- The experience in attempting to eradicate river ruffe from Duluth-Superior Harbor in the 1990s offers "lessons learned" that can be applied in plan development.
- Rapid response plans for Lake Champlain, Puget Sound and the Everglades merit review in developing a Binational AIS Rapid Response Plan for the Lake Huron/ Lake Erie Corridor.

5. *If you had full authority to design the "ideal" protocol for AIS rapid response, what characteristics would it have, and why? Elaborate with regard to a) the type of binational agreement needed; b) the entity (existing or new) to be charged with oversight and coordination authority; and c) the agencies (binational and domestic) that should be involved (at some level) in rapid response planning and implementation.*

- The GLWQA may not be the most appropriate mechanism for a binational agreement given that it already addresses a wide range of issues (i.e., it could prove to be cumbersome).
- The GLFC would be an appropriate entity given its mandate and longstanding experience in AIS prevention and control. Roles could include oversight, coordinating "table top" response exercises, reporting on AIS incidents, and others (provided that the agency received a mandate and funding for such).
- The IJC should be given "moral" authority for binational AIS rapid response, but it is unclear as to whether the two federal governments would support such a role.
- The GLFC model is a very good one if its focus could be broadened, and it could be mandated to serve as a "chief contractor" for AIS rapid response.
- DFO may be the most appropriate federal lead for Canada, and USFWS for the U.S. Other agencies may need to be involved depending on the nature of the plant/ animal of concern.
- Leadership on a binational rapid response action should be coordinated by a single entity, with a lead federal agency from each country. In the U.S., either the USFWS or the USCG would be appropriate; in Canada either EC or the CCG would be appropriate.
- Many agreements are in place on other topics that might offer good templates (e.g., cooperative forest fire response).
- State/ provincial agreements may be most appropriate to avoid potential bureaucracy issues at the federal level.
- It is best to use an existing entity as opposed to establishing a new one. The GLFC is better positioned than IJC to provide binational oversight/ coordinative services.
- The GLWQA can provide a "generic forum" for coordinating rapid response at the binational level, with the IJC as the lead entity. Other entities can have support roles (e.g., GLFC for treatment applications, GLC for policy/ regulatory issues).
- Canadian agencies best positioned to support binational rapid response actions include DFO and MNR. MOE and CAs may have a role as well, along with border services.
- Rapid response actions in domestic waters should be handled accordingly, with binational support and assistance available upon request, as is the case with binational

firefighting agreements, as well how Operation Silver Screen (i.e., Asian carp eradication) was handled in the CAWS. If the response action is in the open waters of a shared resource (e.g., Lake St. Clair), a binational executive group and joint action should be established.

- The most critical need is to have a clearly defined organizational structure driven collaboratively by the affected jurisdictions. A large and complex organizational arrangement should be avoided, with emphasis placed on a mechanism to tap into an existing network of responders and support personnel.
- A renegotiated GLWQA should provide local jurisdictions, as well as state and provincial agencies, with the authority to coordinate response actions rather than leaving this to federal agencies alone.
- ICS needs to drive decisions on lead agencies. It provides for an initial responder that "takes the call", assesses the situation, and decides how to "hand off" responsibilities for the response action.
- The GLWQA can provide a good model and, in particular, Annex 9 addressing response to oil and hazardous material spills.
- An AIS-specific annex in the GLWQA is needed.
- The plan should be complemented by regulatory work to reduce the likelihood of an AIS issue (e.g., ensure that prohibitions on the sale/ movement of live Asian carps are in place and enforced).
- DFO should be a lead agency in Canada for binational rapid response given its legal and political authority.
- Local agencies and non-governmental organizations should be involved, to the extent possible, in response operations. Among others, this should include providing a local liaison function. Having such entities lead mock exercises is a good means to acquire "lessons" for application in actual response events.

6. *How much detail should be provided in a Binational AIS Rapid Response Plan? Should it provide general procedural guidance or should it include explicit step-by-step actions, roles and responsibilities, and response alternatives (e.g., pre-approved chemical treatment options)?*

- The plan should be as detailed as possible but also flexible. Items should include pre-approved (and permitted) treatment protocols, stockpiled treatment chemicals, clearly identified "triggers" (e.g., tests, risk assessment), and clear lines of authority.
- A detailed listing of private contractors and their capabilities should be included in a plan, along with a listing of stockpiled materials (i.e., equipment and chemicals), their location and means to access.
- A binational rapid response protocol should have multiple components including communications, containment management, reconnaissance, decision making matrix, and documentation of initial discovery.
- The plan should be simple and straightforward, focusing on communications and line responsibilities for various jurisdictions, with appendices that provide resources for risk assessment and decision making. ICS should provide the basis for rapid response, and the plan should also incorporate early detection, monitoring and studies of high risk invaders, along with a "tool kit" of pre-approved treatment options.

- The plan should be used as a framework for response. An overarching document that identifies and specifies roles and responsibilities for all interested parties is critical, particularly with regard to designation of lead response entities.
- The plan should have a strong outreach component to ensure that a broad array of parties (including border services, police and judges) fully understand the consequences of the transport of AIS species (e.g., live Asian carps).
- Innovative funding mechanisms need to be developed and incorporated into the plan to ensure a long-term, reliable base of support for all related rapid response activities.
- Provide for a significant role for contractors that can execute rapid response actions.
- "On-the-shelf", pre-approved and permitted treatments should be in place, and the plan should present matrices that identify different treatment protocols and the circumstances under which they should be used.

7. How should the plan be organized; on the basis of specific species, geography (i.e., physical attributes or components of the system being addressed), treatment protocol, or some other parameter?

- A species-specific approach is preferred, organized around taxonomic groups. Beyond that, focus on location-specific issues given that the diversity of conditions in the pilot area (e.g., free-flowing river, tributaries, backwater areas, wetland) will require different approaches. A monitoring plan should be a component of the plan to assist in customizing responses to local conditions.
- A species-specific approach is most appropriate but, given the physical differences between the St. Clair and Detroit River systems, separate (yet linked) plans are in order. "Pinch points" in the system (e.g., Harsen's Island, Walpole Island) should be a focus. Extensive mapping is critical.
- A "pathway" approach has merit given the challenges in accurately predicting species that might be encountered. Consider response strategies based on pathways such as boat launches.
- The first step should be pathway/ geography-based to identify likely high risk areas, followed by a species-specific response.
- Rapid response planning is best organized around groups of organisms; a species-by-species approach would be overwhelming. A "tool kit" of treatment options focused on those groups should be developed.
- The AIS list compiled by USACE for the ongoing GLMRIS effort is a good starting point for identifying potentially relevant species to address.

8. Are their unique attributes of the pilot study area (i.e., Lake Huron/ Lake Erie Corridor) to be mindful of in plan development and implementation? If so, how should those attributes best be addressed?

- Any type of chemical treatment activity must recognize that the pilot area is within a designated AOC where ecosystem restoration activities are underway.
- The substantial flow in the St. Clair River will be an important consideration in the type of response method selected.
- This is a densely populated, heavily used, multiple-use area and, consequently, suggests a high likelihood that new AIS may be introduced.

- There is a strong First Nations presence and interest in the pilot area (Walpole Island) that needs to be recognized and accommodated in the planning and rapid response process. Coordination/ cooperation can be a challenge, and full consultation/ involvement in the planning process is essential.
- The pilot area is populated with a number of individuals, agencies, organizations and academic institutions with substantial expertise that can be brought to bear on the AIS challenge.
- Communication is a vitally important consideration given the pilot area's large population and the extensive, multiple-use characteristics of the resource. There is a need to minimize the likelihood of any individual or group opposing response actions largely because they were not involved in/ consulted during the decision making process.

9. *What are the "top" critical actions that need to be taken to achieve success in plan development and implementation?*

- A reliable methodology to determine the presence of AIS warranting a rapid response action is critical; eDNA is not yet sufficiently reliable.
- It is important to achieve "buy in" from all affected parties (including prospective responders), as well as "official" sign-off by political leadership.
- A "map-based" approach to plan development, focusing on "geographic pathways" of likely AIS introductions, has merit.
- Ensure that the plan has an adequate level of detail with appendices that address such matters as alternative treatment protocols.
- Examine and draw "best practices" from existing models (e.g., Southeast Michigan Area Committee).
- Develop a comprehensive list of rapid response assets that will be dedicated to efforts in the pilot area.
- Achieve "buy in" on the pilot plan, emphasizing its sustainability and value as a template for application elsewhere.
- Look to entities such as the GLC and its Great Lakes Panel on Aquatic Nuisance Species as binational coordinative bodies with advocacy capabilities.
- Enlist the media to emphasize the adverse ecological and economic consequences of AIS, and generate/ sustain support for a binational rapid response capability.

10. *What other comments/ observations/ recommendations might you have for plan development and implementation?*

- A very clear understanding of the respective roles and responsibilities of the many interested agencies and organizations must be articulated prior to any rapid response action.
- A wealth of applicable case studies can be found in multi-state AIS prevention and control efforts; the "lessons learned" from those experiences have relevance at the binational level.

E. Jurisdictional Best Practices for Rapid Response

An earlier report commissioned by the IJC ("Toward a Binational Aquatic Invasive Species Rapid Response Policy Framework", 2009) entailed a comprehensive literature search (107 citations) yielding a series of common themes, or "critical success factors" for consideration in developing AIS rapid response capabilities at the binational level. In undertaking this jurisdictional analysis, these factors were revisited in light of an additional literature review (focusing on approximately 20 AIS rapid response plans) and the outcomes of the eleven interviews presented in the preceding section. Collectively, these analyses provide the guidance needed in four critical areas of Binational AIS Rapid Response Plan development and implementation: 1) generating support for plan development; 2) identifying plan components; 3) effectively executing the plan; and 4) ensuring a long term rapid response capability. This guidance will be reflected in the elements of a subsequent document presenting a draft "Binational AIS Rapid Response Plan" for the Lake Huron/ Lake Erie Corridor".

F. Key Jurisdictional Challenges in Rapid Response Planning and Execution

The IJC Scope of Work for this analysis called for the identification of the "top five" challenges associated with the design and implementation of a Binational AIS Rapid Response Plan. To facilitate their selection, the two preceding "companion" studies (note above) were reviewed, along with the literature search, interview findings and workshop outcomes associated with this investigation. A substantial number of challenges were subsequently identified and screened, first based on the frequency with which they were identified and second, on the basis of their potential (if unresolved) to compromise the effectiveness of rapid response planning and execution activities.

Presented below is the outcome of this analysis, comprised of a brief description of the challenge and the action(s) required to address it.

1. Reconciling/ harmonizing laws, policies, programs and approaches to rapid response planning and execution.

Challenge: The legal/ programmatic framework for AIS prevention and control in the binational Great Lakes-St. Lawrence River Basin is both limited and fragmented and, in certain instances, conflicting. Legislation at the federal, state and provincial levels generally lacks comprehensiveness and a Basin-wide focus. Roles and responsibilities of various public entities are generally not well defined and, where they exist, rapid response plans/ protocols are often developed on a geo-political, as opposed to watershed or Basin-wide basis. The lack of a well-developed and defined framework at the binational level compromises all aspects of plan development and execution, including (among others) such elements as monitoring, risk assessment, selection of treatment protocols, funding arrangements and organization of leadership for plan execution.

Response: Resolving the above challenge is a long-term proposition requiring legislative actions and programmatic modifications in multiple jurisdictions. However, it need not be resolved *prior* to initiating development of a Binational AIS Rapid Response Plan. Rather, the plan development process itself can overcome some of these issues while also establishing a mechanism to address them over time. To accomplish this, the binational legal mechanism

mandating plan development (whether it be the renegotiated GLWQA or separate, AIS-specific agreement) can explicitly provide for an *ongoing* analysis and resolution of inconsistencies and gaps in laws, policies and programs at the interjurisdictional level. Further, coordinating bodies (e.g., Great Lakes Panel on Aquatic Nuisance Species) can be requested to support this effort by developing protocols (e.g., risk assessment, monitoring, treatment) specifically oriented toward the Lake Huron/ Lake Erie Corridor.

2. Designing an institutional structure acceptable to all parties.

Challenge: Personal interviews and workshop outcomes associated with this study elicited a diversity of opinion relative to appropriate lead entities for AIS rapid response in a binational setting. In addition, the jurisdictional analysis identified literally dozens of entities within the Lake Huron/ Lake Erie Corridor with a prospective role in/ responsibility for some aspect of rapid response. Considerable prospective overlap in roles and responsibilities was identified. Further, hesitancy for certain agencies to accept a leadership role in a binational setting was expressed due to issues/ questions relating to agency authority, mission, resources/ capacity, capabilities and liability.

Response: Plan design and execution will be based on the ICS framework given its broad acceptance by the responder community. Within that framework, the "pool" of relevant entities to be involved at some level (e.g., Command Team, On-site Coordinators, Scientific Advisors, Field Teams) will be explicitly identified based upon the analysis conducted to date, as well a designated entity to administer and maintain the plan. Further, the plan development process should be an inclusive one, with input solicited (at the minimum) from the range of entities identified in this study. This should include a request that all entities with a proposed role in plan development and execution confirm their willingness to participate. Finally, as recommended by numerous individuals, the plan will be a "living" document: it will be refined, over time, to address evolving needs, preferences and new information.

3. Securing and sustaining financial and political support for the plan and its execution.

Challenge: AIS infestations demanding rapid response actions are not presently recognized as "emergencies" in either the U.S. or Canada. Further, with the exception of highly publicized media "events" (i.e., Asian carp infestation threats), the magnitude of prospective ecological and economic threats associated with current (or impending) infestations is poorly understood. Other challenges in securing and sustaining requisite financial and political support include the perceived lack of an imminent threat; a natural tendency toward "crisis response" within public institutions; competing priorities in an era of fiscal austerity; the potentially formidable costs associated with plan maintenance and execution (e.g., monitoring, training, research, development of treatment protocols, material acquisition/ stockpiling, mobilization); and potentially complex interjurisdictional issues in a binational setting (e.g., roles, authorities, funding).

Response: Sustained support for AIS rapid response will require that plan development and execution be explicitly mandated via binding mechanisms (e.g., legislation in relevant jurisdiction, provisions in a revised GLWQA and/or another binational vehicle). Among others, this can include regular appropriations from federal/ state/ provincial legislatures and/or a dedicated fund to support specific response functions. To facilitate and sustain this support, a

concerted and well-coordinated campaign is needed to inform elected officials and the general public of the ecological and economic consequences of inaction, and the "return on investment" (i.e., cost avoided) of a successful rapid response action. Further, the entity charged with administering and maintaining the plan (as well as participating agencies), must assume an active public information function to (among others) highlight plan benefits, report on successful actions, and publicize training exercises.

4. Ensuring an adequate understanding of target species, treatment options and associated ecological impacts including inter-species considerations. '

Challenge: Significant uncertainty exists relative to targeting "high risk" AIS in the Lake Huron/ Lake Erie Corridor. While there is presently no list specific to the Corridor, preparing such will be an essential, yet formidable and time consuming task given the substantial number of AIS of concern at the Basin-wide level. Further, while some understanding of the likely ecological impacts of various AIS is available, much of that information is not specific to the Corridor. This is also true (with limited exceptions) for inter-species interactions (i.e., how a given treatment affects non-target species), as well as how the treatment may affect other elements of the targeted area (e.g., water infrastructure, water quality, habitat).

Response: A concerted effort is needed to review basin-wide AIS lists (see previous discussion), as well as the peer-reviewed literature, to generate an initial prioritized list of high risk species that are, or likely to be established in the Corridor. Associated with this effort must be research targeted at these species to further verify those with "high risk" status (i.e., potentially warranting a rapid response action); more thoroughly characterize ecological impacts; and identify optimal treatment options and their implications. This can be initiated independent of the plan development process, and subsequently identified in the plan as a priority for continuous updating and refinement. The resultant data and information should be incorporated into a plan appendix.

5. Developing and securing pre-approvals for treatment protocols.

Challenge: Procedures for registering chemicals for AIS control vary substantially between the U.S. and Canada, and must be harmonized for applications in binational waters. The registration process is typically time consuming and expensive, and can also be complicated by limited availability of certain chemicals. In addition, non-chemical treatments (e.g., mechanical, biological) also need to be assessed and documented to ensure effectiveness. Therefore, prospective treatment protocols must be developed, registered/certified and made available (i.e., staged or stockpiled) for ready access in the event of a future AIS infestation deemed to merit rapid response.

Response: As with item #1 above, addressing this challenge will be a long- term, evolving proposition that can be facilitated through the development of the binational AIS rapid response plan. The plan should include an appendix with a detailed inventory of all known treatment methodologies specific to high risk species known to be present in, or capable of infesting the waters of the Lake Huron/ Lake Erie Corridor. The inventory should be organized around individual AIS (or categories of AIS) and, for each, include background on such details as the species' origin; pathway; ecological preference (i.e., known or likely location); ecological impact (including inter-species); treatment option(s); certification or registration

information for the treatment option(s); availability and location of relevant equipment/ material/ chemical; agency or contractor with application experience; references to the scientific literature; and related items. The treatment inventory prepared for the IJC is an appropriate starting point for this exercise ("Aquatic Invasive Species Detection and Rapid Response – Assessment of Chemical Response Tools", July 2011).

The plan should provide a process whereby this list is regularly updated and expanded. In addition, the plan should commit the U.S. and Canadian federal governments to develop and implement streamlined testing and registration procedures to expedite treatment approvals. To facilitate this, consideration should be given to a standing committee on Treatment Evaluation and Certification that will guide the process and expedite approvals for highest priority treatment needs.

IV. Selecting a "Preferred" Plan for AIS Rapid Response

A. Alternative Models for AIS Rapid Response Planning and Execution

Previous analysis by the IJC Work Group on AIS Rapid Response addressed alternative frameworks for response actions. Three models were examined in a 2009 report ("Toward a Binational Aquatic Invasive Species Rapid Response Policy Framework") and consisted of:

- An ad hoc (i.e., reactive) approach characterized by development of a plan and associated response strategy *following* an AIS introduction (e.g., Eurasian ruffe experience in Duluth-Superior Harbor, snakehead in Arkansas);

- A collaborative approach characterized by broad plans and response frameworks- often at a jurisdictional level- that provide overall response guidance, but rely upon relevant parties to determine specific implementation procedures (e.g., Model Rapid Response Plan for Great Lakes Aquatic Invasions, Rapid Response to New Aquatic Invasive Species in Michigan); and

- A "command and control" approach that embraces the ICS model or its corollary (Unified Command- UC) for rapid response efforts (e.g., CANUSLAK, USEPA Preparedness and Response Plan, NPS Emergency Prevention and Response Plan for Viral Hemorrhagic Septicemia, Asian Carp Monitoring and Rapid Response Plan).

The Work Group determined that the first approach is unacceptable, recognizing that the complexity of AIS introductions (particularly in a binational setting) precludes the possibility of a successful eradication or containment effort based upon this "reactive" model. The second model does add value to the collective AIS rapid response effort, but lacks the specificity and binational features needed for a prompt and aggressive response to a given introduction.

The third approach, as noted by the Work Group, embraces the ICS/UC model, has characteristics that are particularly well-suited to the physical, biological, jurisdictional and institutional complexity of the Great Lakes- St, Lawrence River Basin. This model offers clear lines of authority and emphasizes pre-agreements among all relevant parties, and pre-approval

of treatment techniques and operating procedures to ensure that undue delays are avoided following detection of an AIS warranting rapid response. The Work Group has also noted that this model has been successfully employed in multiple settings, is familiar to many federal/ state/ provincial/ local officials, and is the instrument of choice for the majority of AIS rapid response plans in place or under development.

Within the third model, of course, is a range of specific structural and operational alternatives that must be considered in the planning, organizational design and implementation process.

B. Desired Structural and Operational Characteristics: Experts Workshop

The IJC's Work Group on AIS Rapid Response hosted a December 1, 2011 workshop titled, "Binational AIS Rapid Response Planning for the Great Lakes- St. Lawrence Basin." Conducted in conjunction with a meeting of the Great Lakes Panel on Aquatic Nuisance Species, the purpose of the workshop was to solicit expert advice and opinion on designing the "ideal" binational Rapid Response Plan for the Lake Huron/ Lake Erie Corridor. The workshop included opening remarks by the U.S. Chair of the IJC (The Honorable Lana Pollack), a panel discussion of "practical/ pragmatic" advice for the development of a binational plan, and facilitated breakout group discussions organized around several key questions. Approximately 30 individuals representing a range of interested parties participated in the workshop including public sector officials (i.e., binational, federal, state, provincial, regional, local); citizen organizations; user groups; and academia.

Three facilitated breakout sessions were conducted utilizing the Nominal Group Technique to ensure that that all participant viewpoints were shared. Breakout session participation was organized to ensure a representative cross section of interested parties within each group. Presented below is a consolidated summary of key points, organized under each of the four key questions posed to the participants. This is followed by a brief analysis to highlight points of strong consensus, and, where relevant, differing opinion.

1. What is the preferred framework for rapid response at the binational level?

- A rapid response plan should provide for a dedicated funding source (i.e., "war chest" or standing fund) with long term reliability.
- Formal agreements/ Memoranda of Understanding (MOU) among response entities must be finalized in advance of any response action.
- Cross border (i.e., binational) agreements are particularly important.
- Leadership must be pre-designated, as is the case with the Great Lakes "oil spill model."
- A "hotline" should be maintained by both MDNR and MNR to address initial AIS reports and initiate the ICS process.
- The rapid response framework must accommodate issues/ concerns associated with private lands and public trust, among others.
- While we can learn from other rapid response approaches (e.g., interjurisdictional forest fire responses), AIS issues tend to be more complex and with more uncertainties.
- CANUSLAK is a good model for the pilot area.

2. *What key components (structural/operational) are key to a successful plan?*

- From both a structural and operational standpoint, the plan must be flexible and adaptable to adjust to changing agency missions, funding priorities, politics, etc.
- Clearly define what is meant by "rapid response" in the interest of clarifying expectations among interested parties.
- Coordination and communications mechanisms must be prominently featured in a rapid response plan to ensure adequate access to funding, equipment, etc.
- A clear organizational structure/ hierarchy/ chain of command, including detailed roles and responsibilities, must be identified and fully understood by all parties.
- A safety component must be included to protect responders, resource users, and other parties in proximity to the response area.
- The plan must include a regularly updated descriptive inventory of resources (i.e., personnel, equipment, chemicals, funding) that are readily available to support a rapid response action.
- The plan must include a rapid assessment component, following initial detection, to determine whether (and what type of) rapid response action may be warranted.
- End points must be specified to identify when a rapid response action is complete and determine the extent to which objectives have been met. These end points must be specified in advance, and may vary from eradication to containment.
- Conformance with all domestic and binational regulatory requirements must be accomplished prior to a rapid response action. Further, laws and regulations specific to the area of the response action should be identified and understood prior to selection of a rapid response option.
- Prospective impacts upon non-target species must be anticipated and addressed.
- A post-response monitoring and evaluation process is needed to assess success, identify any necessary follow-up actions, undertake adaptive management efforts (if needed) and benefit from "lessons learned".
- A well-defined and "unified" reporting protocol must be included in the plan process.
- A comprehensive data base to inform the decision making process is needed, and should include information on the pilot area's physical, biological and chemical characteristics (including identified AIS and those the area may be subject to), relevant infrastructure and facilities, and any other data that will assist in the selection and application of a response action.
- Barriers to rapid response (due to the binational nature of the pilot area) must be anticipated and addressed in the plan.
- Risk assessment needs to be the basis of the planning process, as it is critical to determining the scale of a prospective response. One determinant will be the behavior of the AIS and, therefore, an understanding is needed of the organism's ecology, capability to spread, etc.
- A clearly stated and understood "trigger mechanism" is needed to determine when rapid response is warranted. Consideration should be given, among others, to the scale of the issue, outcomes of a rapid assessment, and the binational nature of the AIS threat.
- Training exercises ("table top" and in the field) should be regularly conducted.
- Appropriate use of contractors in various aspects of the rapid response process should be considered.
- Engage border patrol agencies in AIS rapid response initiatives, as appropriate.

- Establish and maintain a team specializing in rapid response, perhaps modeled after Disaster Response Assistance Teams (DRATs).

3. *Which "high risk" species are of greatest concern for plan development?*

- High risk species should be categorized to facilitate determination of appropriate response actions (i.e., fish, mussels, benthos, plants).
- An "example" species in each category can be selected to serve as a "template" for a response action, and can be "tweaked" for other species in that category.
- Species of particular concern include Asian carps, Hydrilla, Killer shrimp, Golden mussel, Snakehead, Water lettuce, Water hyacinth.
- Review the GLANSIS "watch" list.
- Highly mobile species are the most challenging to eradicate/ contain and, therefore, are of particularly high risk.

4. *How can we encourage "buy in" to plan implementation by key jurisdictions?*

- The benefits of rapid response (and the consequences of inaction) need to be stated quantitatively, where possible, and conveyed to elected officials and other policy makers. This includes the negative ecological and economic consequences if an AIS issue is not addressed via rapid response.
- Entities involved in the Joint Command will have liability concerns; insurance coverage will be an important component of the planning and execution process.
- Make a compelling case that rapid response goals are achievable, and manage expectations on a response-specific basis.
- Demonstrate and publicize success, where possible, with similar rapid response initiatives.
- Involve key parties in plan development and implementation.
- Simplicity and clarity in plan design will assist in garnering support.
- A well-researched and science-based plan will generate confidence.

Table 2

AIS RAPID RESPONSE CAPABILITY (CURRENT/ PROSPECTIVE)[1]											
Agency/ Organization	Planning	Coordination	Research	Science Advice	Equipment/ Material	Policy/ Regulatory	Education/ Outreach	On-site Execution	Monitoring/ Surveillance	Funding	Advocacy
	1	2	3	4	5	6	7	8	9	10	11
BINATIONAL/ INTERNATIONAL											
International Joint Commission (IJC)	2	2	2	1	3	2	2	3	3	2	2
Great Lakes Fishery Commission (GLFC)	1	1	1	1	2	1	2	1	2	1	1
Great Lakes Commission (GLC)/ Great Lakes Panel on ANS	2	2	2	2	3	2	1	3	3	2	1
Council of Great Lakes Governors (CGLI)	2	2	3	2	3	2	2	3	3	3	1
Great Lakes St. Lawrence Cities Initiative (GLSLCI)	3	1	3	3	3	2	1	3	3	3	1
Great Lakes Regional Collaboration (GLRC)	2	2	3	2	3	2	2	3	3	1	1
Midwest Natural Resources Group (MNRG)	2	2	3	2	3	2	2	3	3	3	2
Four Agency Management Committee	2	2	3	2	5	2	2	3	2	2	2
Binational Public Advisory Councils-St. Clair and Detroit Rivers (BPACs)	2	2	3	2	3	2	2	3	2	2	2
International Maritime Organization (IMO)	2	3	2	2	3	2	3	3	3	3	3
International Council for the Exploration of the Sea (ICES)	2	3	2	2	3	2	3	3	3	3	3
Council for Envrionmental Cooperation (CEC)	2	2	2	2	3	2	3	3	3	3	3
Department of Fisheries and Oceans (DFO)	1	1	1	1	1	1	2	1	1	1	2
Environment Canada (EC)	1	1	1	1	2	1	2	2	1	1	2
Canadian Council of Fisheries and Aquaulture Ministers (CCFAM)	2	2	2	2	3	3	2	2	3	2	2
Health Canada	2	3	2	2	3	2	2	3	3	3	3
Natural Resources Canada (NRC)	2	2	2	2	2	2	2	2	2	2	2
Transport Canada (TC)	1	1	2	2	2	1	2	1	2	2	2
Agriculture and AgriFood Canada (AAFC)	2	3	2	2	3	2	2	3	3	3	3
Parks Canada	2	3	2	2	3	2	2	3	2	2	2
Canadian Border Services Agency (CBSA)	2	2	3	3	2	2	2	2	2	2	2
Canadian Food Inspection Agency (CFIA)	3	3	2	2	3	2	3	3	2	2	3
PROVINCIAL											
Ontario Ministry of Natural Resources (MNR)	1	1	2	1	1	1	2	1	1	2	2
Ontario Ministry of the Environment (MOE)	1	2	2	1	1	1	2	1	1	2	2
Ontario Ministry of Health and Long-term Care	3	3	2	2	3	3	2	3	3	3	3
Ontario Ministry of Transport (MTO)	2	2	3	3	2	2	3	2	3	3	3
Ontarion Ministry of Agriculture, Food and Rural Affairs (OMAFRA)	3	3	2	2	3	2	2	3	2	2	3
Ontario Parks	2	2	2	2	3	2	2	3	2	3	2
Quebec Ministries	2	3	2	2	3	3	3	3	3	3	3
CA REGIONAL/ MUNICIPAL											
Conservation Authorities- CAs	1	1	2	2	3	1	1	2	1	2	2
Local Public Health Units (Lambton, Chatham-Kent, Widsor-Essex)	3	3	2	2	3	2	2	3	2	3	3
Ontario Counties	2	2	3	3	2	2	2	2	2	3	2
Ontario Municipalities (major)	2	2	3	3	2	2	2	2	3	3	2

Notes:
1) The numerical assignments are as follows: A "1" indicates a current/ prospective capability to serve a "primary" role in the function identified.
A "2" indicates a "support" role capability. A "3" indicates "limited" or no capability to perform the identified function.
2) "Other" includes academia, business/ industry associations, inter-agency consortia and non-profit entities.

Table 2

AIS RAPID RESPONSE CAPABILITY (CURRENT/ PROSPECTIVE)[1]

Agency/ Organization	Planning	Coordination	Research	Science Advice	Equipment/ Material	Policy/ Regulatory	Education/ Outreach	On-site Execution	Monitoring/ Surveillance	Funding	Advocacy
	1	2	3	4	5	6	7	8	9	10	11
U.S. FEDERAL											
Aquatic Nuiance Species Task Force	2	3	2	2	3	2	2	3	3	3	3
National Invasive Species Council	2	3	2	2	3	2	2	3	3	3	3
U.S. Fish and Wildlife Service (USFWS)	1	1	1	1	1	1	2	1	1	1	2
U.S. Geological Survey (USGS)	2	2	1	1	2	2	2	2	2	2	2
National Oceanic and Atmospheric Administration (NOAA)	2	2	1	1	2	2	2	2	2	2	2
U.S. Army Corps of Engineers (USACE)	1	1	2	2	2	2	2	12	2	2	2
U.S. Coast Guard (USCG)	1	1	2	2	2	1	2	1	2	2	2
U.S. Environmental Protection Agency (USEPA)	1	1	1	1	2	1	2	1	1	1	2
Animal and Plant Health Inspection Service (APHIS)	2	3	2	2	3	2	2	3	3	3	3
National Park Service (NPS)	2	3	2	2	3	2	2	3	2	3	3
U.S. Department of Transportation (USDOT	2	2	2	3	2	2	2	2	3	3	3
Centers for Disease Control and Prevention (CDCP)	3	3	2	2	3	3	3	3	3	3	3
STATE											
Michigan Department of Natural Resources (MDNR)	1	1	2	2	2	1	2	1	1	1	2
Michigan Department of Environmental Quality (MDEQ)	1	1	2	2	2	1	2	1	1	1	2
Michigan Department of Agriculture (MDA)	2	2	2	2	3	2	2	3	3	3	3
Michigan Department of Public Health (MDPH)	3	3	2	2	3	2	2	3	3	3	3
Michigan Department of Transportation (MDOT)	2	2	3	3	2	2	3	2	3	3	3
U.S. REGIONAL/ MUNICIPAL											
Michigan Counties	2	2	3	3	2	2	2	2	2	3	2
Southeast Michigan Council of Governments (SEMCOG)	2	2	3	3	3	2	2	3	3	3	2
Watershed Councils- Michigan	2	2	3	2	3	2	1	3	2	3	1
Southeast Michigan Area Planning Committee	2	2	2	2	2	2	2	2	3	3	2
Michigan Municipalities (major)	2	2	3	3	2	2	2	2	3	3	2
NATIVE AMERICAN TRIBES/ FIRST NATIONS											
Walpole Island First Nation	2	2	2	2	3	2	2	2	2	3	2
Fisrt Nations Reserves	2	2	3	3	3	2	2	3	2	3	2
Chippewa-Ottawa Resource Authority (CORA)	2	3	3	3	3	2	2	3	2	3	2
Great Lakes Indian Fish and Wildlife Commission (GLIFWC)	2	3	3	3	3	2	2	3	2	3	2
Anishinabeck/Ontario Fisheries Resource Centre (A/OFC)	2	2	2	2	3	2	2	3	3	3	2
Other[2]											
Invasive Species Centre (ISC)	1	1	1	1	3	2	2	3	2	2	1
Council of Great Lakes Industries (CGLI)	3	2	3	3	3	3	2	3	3	3	2
Lake Carriers Association (LCA)	2	2	3	3	2	3	2	3	3	3	2
Great Lakes Institute for Environmental Research (GLIER)	2	3	1	1	3	3	2	3	2	3	2
Michigan Sea Grant Program	2	2	2	2	3	2	1	3	2	3	2
Canadian and American Water Resources Associations (CWRA and AWRS)	3	3	2	2	3	3	2	3	3	3	2
International Association for Great Lakes Research (IAGLR)	2	3	1	1	3	2	3	2	3	3	1
Professional Assoications (multiple)	3	2	2	2	3	3	2	3	3	3	2
Environmental NGOs (multiple)	2	2	2	2	2	3	2	1	2	3	1

Notes:

1) The numerical assignments are as follows: A "1" indicates a current/ prospective capability to serve a "primary" role in the function identified. A "2" indicates a "support" role capability. A "3" indicates "limited" or no capability to perform the identified function.

2) "Other" includes academia, business/ industry associations, inter-agency consortia and non-profit entities.

- Perform education and outreach on an ongoing basis to generate and maintain support for rapid response efforts.
- Engage local subject area experts in rapid response planning and execution.
- Address the "what's in it for me?" question that may arise from decision makers or relevant jurisdictions/ agencies/organizations.
- Provide a funding incentive for jurisdictions to participate in planning and response activities.

C. Analysis of Selected AIS Rapid Response Plans

Approximately 30 state and provincial AIS management plans (dedicated fully or partially to rapid response) were reviewed in detail, along with approximately a dozen other rapid response plans that either serve as generic models or focus on specific watersheds or species. (See Appendix A). Criteria guiding the analysis were drawn from the outcomes of the previously discussed personal interviews and Experts Workshop (as presented in this report), as well as the outcomes of the two aforementioned IJC Work Group reports ("Toward a Binational Aquatic Invasive Species Rapid Response Policy Framework"- 2009 and "Gap Analysis: Asian Carp Rapid Response Planning and Implementation"- 2011).

The analysis sought to identify one or more plans that might serve (wholly or in part) as a template for a pilot Binational AIS Rapid Response Plan for the Lake Huron/ Lake Erie Corridor. As such, the "ideal" template would embrace ICS as an organizing function; present clearly stated and logical steps for rapid response; define organizational and operational responsibilities; and be of sufficient detail to provide guidance in an actual AIS response scenario.

The analysis identified one document, "Rapid Response Planning for Aquatic Invasive Species- A Maryland Example" (Mid-Atlantic Panel on Aquatic Invasive Species, January 2009) as particularly relevant to the pilot plan for the Corridor. In addition, the "Lake Champlain Basin Rapid Response Action Plan for Aquatic Invasive Species" (Lake Champlain Basin Program, Rapid Response Workgroup, May 2009) had numerous positive attributes as well, including an extensive appendix with processes and forms to further guide a response action. These two documents, along with selected components of numerous others also reviewed, will inform the development of a pilot plan, to be presented in a subsequent IJC Work Group report.

V. Findings and Recommendations

A series of findings and associated recommendations emerge from project analysis, shaped by a review of the literature, the outcomes of individual interviews and an Experts Workshop, and a thorough analysis of institutional capabilities for AIS rapid response in the Lake Huron/ Lake Erie Corridor. Findings are followed by recommended actions as the IJC Work Group proceeds to the pilot plan development stage.

<u>Findings</u>

- The Lake Huron/ Lake Erie Corridor constitutes a highly appropriate location for the development of a pilot binational AIS Rapid Response Plan. The Corridor, for

example, is 1) among the most vulnerable areas in the Great Lakes-St. Lawrence River Basin to the infestation and establishment of AIS populations; 2) the sole hydrologic connection between the lower and upper components of the Basin System; 3) a major migration route for a range of species; 4) highly developed with multiple uses that can facilitate AIS introductions (e.g., commercial navigation, recreational boating, sport fishing); and 5) characterized by a variety of physical and ecological features (e.g., open fast flowing water, backwater, wetlands, tributaries) that will require examination of multiple response scenarios. In addition, this binational pilot plan will be instrumental in assisting both Canada and the U.S. in meeting AIS-related goals embodied in the recently renegotiated GLWQA.

- AIS planning efforts to date- in the Lake Huron/ Lake Erie Corridor (and throughout the Great Lakes-St. Lawrence River Basin) have been largely directed at prevention as opposed to response. The former remains the preferred "first line of defense" against AIS. Accordingly, planning efforts have focused on programs that include education/ outreach, promoting best practices, and promulgating regulations.

- A binational AIS response protocol capable of rapidly mobilizing agencies, resources and species-specific treatment techniques (in the Lake Huron/ Lake Erie Corridor or at the Great Lakes-St. Lawrence River Basin level) does not presently exist. However, a foundation for such is gradually being laid by an increasing number of jurisdictions, lake and/or species-specific planning exercises at the domestic level in Canada and the U.S.

- The "institutional infrastructure" of the Lake Huron/ Lake Erie Corridor poses both challenges and opportunities for Binational AIS Rapid Response Plan development and implementation. The Corridor is characterized by a very complex array of institutions (and associated laws, policies and programs) that must be harmonized to ensure a consistent, coordinated and rapid response to AIS introductions. Recent years, however, have seen increased interest in, and political support for a Binational AIS Rapid Response Plan, and the emergence of jurisdiction-specific planning initiatives to build upon.

- Approximately 100 Canadian, U.S. and binational entities (public and non-governmental) operating in and/or relevant to the Lake Huron/ Lake Erie Corridor were determined to have some level of current/ potential capability to lead/ support AIS rapid response efforts in the Corridor. These capabilities can be categorized as 1) primary planning and execution; 2) planning, scientific and monitoring support; and 3) policy, advocacy, education and outreach support.

- The "top" challenges to be addressed in the development of an AIS Rapid Response Plan include organizational, political and scientific considerations. They include the need to 1) reconcile and harmonize laws, policies, programs and approaches across jurisdictions; 2) design an institutional structure acceptable to all parties; 3) secure and sustain funding and political support over the long term; 4) ensure an adequate understanding of target species, treatment options, associated ecological impacts, and inter-species considerations; and 5) develop and secure pre-approvals for treatment protocols, whether they be chemical, mechanical or biological.

- While AIS prevention and control efforts in the Lake Huron/ Lake Erie Corridor are benefitting from continued basic and applied research, significant gaps remain. For example, 1) a Corridor-specific listing a high risk AIS is urgently needed to guide planning efforts; and 2) further study of the nature of inter-species relationships (i.e., between native and invasive species) is needed to develop and refine treatment protocols (i.e., chemical, mechanical, biological) that effectively target high risk AIS without undue adverse impacts on native species.

- Based upon extensive interviews, the Experts Workshop and analysis of "best practices" in other AIS rapid response settings, consensus has emerged relative to desirable structural and operational characteristics of an AIS Rapid Response Plan for the Lake Huron/ Lake Erie Corridor. Desirable structural characteristics include, among others, a designated lead agency(ies) with requisite authority(ies); a planning jurisdiction defined by hydrologic boundaries; well-defined roles for all relevant parties spelled out in pre-agreements; clear lines of authority and accountability; monitoring, early detection and rapid scientific assessment components; and adequate (and equitably allocated) funding support for both program maintenance and incident-specific activities.

- Desired operational characteristics for a binational rapid response plan include, among others, pre-approved SOPs and "on-the shelf" treatment methodologies (e.g., chemical, mechanical, biological); risk assessment methodologies to characterize and prioritize AIS threats; continuous coordination with, and communication among relevant parties; ongoing plan adaptation and training to accommodate evolving needs and new technology; and the cultivation/ maintenance of support from political leadership and the general public.

<u>Recommendations</u>

Based upon the key findings above, the following recommendations are offered to the IJC's Work Group as development of the pilot AIS Rapid Response Plan for the Lake Huron/ Lake Erie Corridor moves forward:

1. The following entities should have key roles in AIS rapid response planning and execution for the Lake Huron/ Lake Erie Corridor:

    - International/ Binational: GLFC; IJC
    - Canadian Federal: DFO, EC;
    - Canadian Provincial: MNR;
    - Canadian Regional/ Local : CA, county(ies) and municipality(ies) proximate to rapid response action;
    - U.S. Federal: USFWS, USEPA;
    - U.S. State: MDNR, MDEQ;
    - U.S. Regional/ Local: SEMCOG, county(ies) and municipality(ies) proximate to rapid response action; and
    - Tribal/ First Nations: Walpole Island First Nation

Multiple other entities have current/ prospective capability to support primary responders via planning, science and monitoring and/or policy, advocacy, education and outreach. (See Figure 3.)

2. Selected existing AIS Rapid Response Plans (i.e., State of Maryland, Lake Champlain) should be used as guidance in developing a pilot plan for the Lake Huron/ Lake Erie Corridor. The "Planning P" approach in the Maryland plan, adopted from that used by the USCG in its emergency response actions, is well suited to the Corridor. In addition, guidance provided in this report, as well as that in a preceding (2009) report to the Work Group ("Toward a Binational Aquatic Invasive Species Rapid Response Policy Framework"), should provide the basis for pilot plan development. This includes adoption of the ICS framework, and the various structural and operational characteristics identified for Binational AIS Rapid Response Plan design, execution and maintenance.

3. Research gaps should be addressed promptly in the interest of informing the development and application of the pilot plan. As noted above, this includes 1) development of a Corridor-specific listing of high risk AIS; and 2) enhanced understanding of the nature of inter-species relationships (i.e., between native and invasive species) to facilitate refinement of treatment protocols (i.e., chemical, mechanical, biological) that target high risk AIS without undue adverse impacts on native species.

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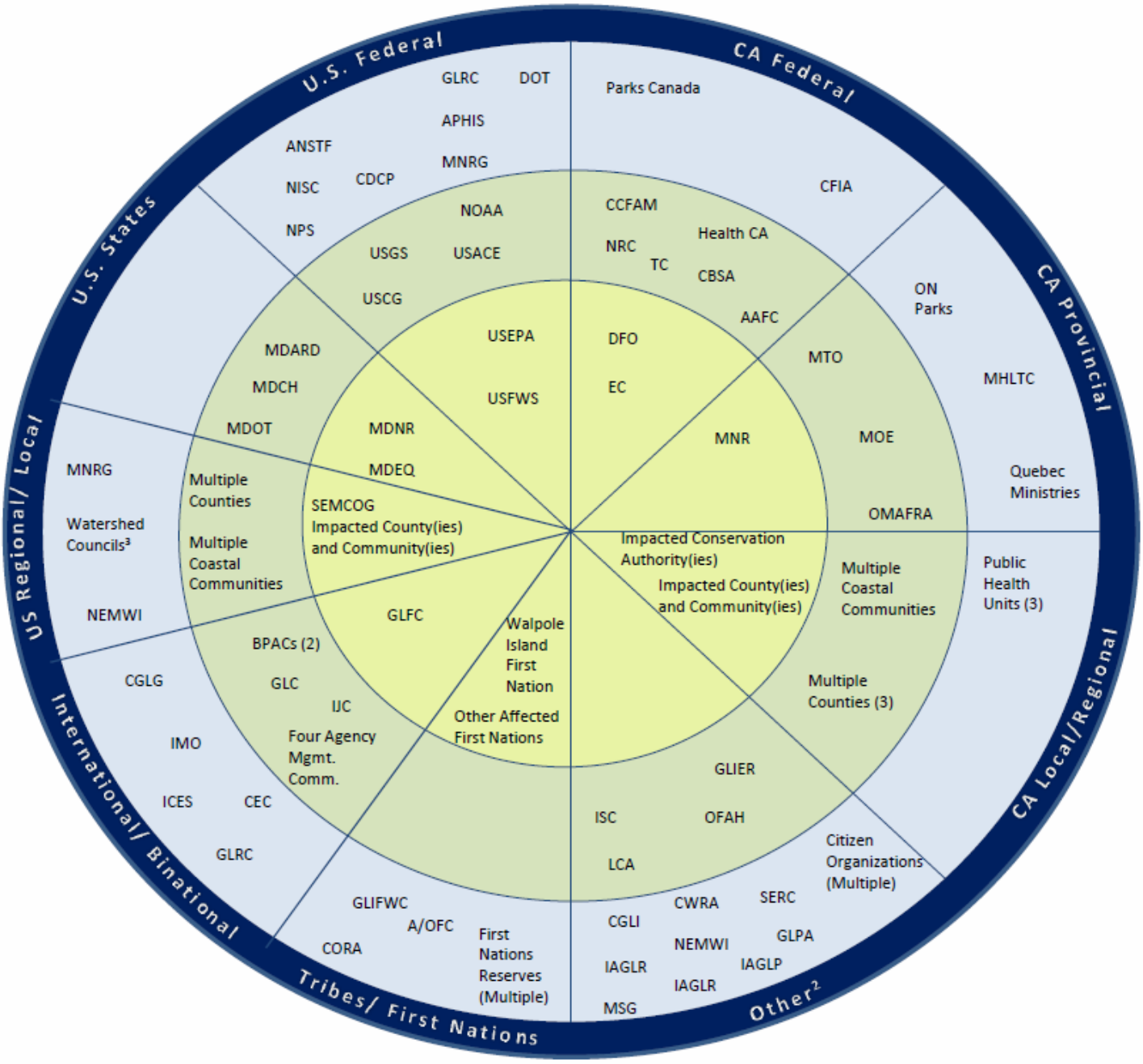
Figure 3. Prospective Roles in AIS Rapid Response – Lake Huron/ Lake Erie Corridor[1]



Notes:

1. Institutions with prospective primary responsibilities for planning and execution appear in yellow background.
   Those with a key support role (e.g., planning, monitoring, scientific analysis) appear in the green background.
   Those with a secondary support role (e.g., education/ outreach, policy analysis, advocacy, as-needed consultation) appear in the blue background.

2. "Other" includes academia, business/ industry associations, inter-agency consortia and non-profit entities.

APPENDICES

Appendix A: References

(Note: Internet links are provided where available.)

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Appendix B: Interview Subjects

Each of the following individuals participated in an in-depth interview (via telephone or in-person) to inform various elements of the study. The guidance questions and summary of responses are presented (without attribution) in Section III.D.

Bill Bolen, Senior Advisor, U.S. Environmental Protection Agency, Great Lakes National Program Office

Mark Bohm, AIS Coordinator, Biodiversity Brach, Policy Division, Ontario Department of Natural Resources

Mark Burrows, Senior Scientist and Secretary, Council of Great Lakes Research Managers, International Joint Commission

John Dettmers, Ph.D., Senior Fisheries Biologist, Great Lakes Fishery Commission

Roger Eberhardt, Senior Environmental Specialist, Office of the Great Lakes, Michigan Department of Environmental Quality

Kathe Glassner-Shwayder, Senior Project Manager and Staff Support, Great Lakes Panel on Aquatic Nuisance Species, Great Lakes Commission

Doug Keller, Aquatic Invasive Species Coordinator, Indiana Department of Natural Resources

Francine MacDonald, Senior Invasive Species Biologist, Ontario Ministry of Natural Resources

Chris Wylie, Aquatic Invasive Species/ Great Lakes Water Quality Agreement Coordinator, Fishers and Oceans Canada/ Transport Canada

Gary O'Keefe, Program Manager, Great Lakes and Mississippi River Interbasin Study, U.S. Army Corps of Engineers

Luke Skinner, Supervisor, Invasive Species Unit, Minnesota Department of Natural Resources

Appendix C: Acronyms

AAFC- Agriculture and Agri-Food Canada
ACRCC- Asian Carp Regional Coordinating Committee
AGL- Alliance for the Great Lakes
AGLP- American Great Lakes Ports
AIS- Aquatic Invasive Species
ANSTF- Aquatic Nuisance Species Task Force
AOC- Area of Concern
A/OFC- Anishinabek/ Ontario Fisheries Resource Centre
APHIS- Animal Plant Health Inspection Service
AWRA- American Water Resources Association
AWWA- American Water Works Association
BEC- Binational Executive Committee
BPAC- Binational Public Advisory Committee
BUI- Beneficial Use Impairment
CA- Conservation Authority
CAISN- Canadian Aquatic Invasive Species Network
CANUSLAK- Joint Marine Pollution Control Contingency Plan
CAWS- Chicago Area Waterways System
CBSA- Canadian Border Services Agency
CCFAM- Canadian Council of Fisheries and Aquaculture Ministers
CCG- Canadian Coast Guard
CCIW- Canada Centre for Inland Waters
CDCP- Centers for Disease Control and Prevention
CEA- Citizens Environmental Alliance
CEARA- Centre of Expertise for Aquatic Risk Assessment
CEC- Council on Environmental Cooperation
CEPA- Canada Environmental Protection Act
CFIA- Canadian Food Inspection Agency
CFR- Code of Federal Regulations
cfs- cubic feet per second
CGLG- Council of Great Lakes Governors
CGLI- Council of Great Lakes Industries
CMA- Canada Maritime Act
CMAC- Canadian Marine Advisory Committee
cms- cubic metres per second
COA- Canada Ontario Agreement
CORA- Chippewa Ottawa Resource Authority
CSA- Canada Shipping Act
CTA- Canada Transportation Act
CWA- Clean Water Act, Canada Water Act, Canada Wildlife Act
CWRA- Canadian Water Resources Association
CWS- Canadian Wildlife Service
DFAIT- Department of Foreign Affairs and International Trade

DFO- Department of Fisheries and Oceans
DHS- Department of Homeland Security
DOS- Department of State
DOT- Department of Tranportation
DRATs- Disaster Response Assistance Teams
DRCCC- Detroit River Canadian Clean-up Committee
EC- Environment Canada
EEA- Environmental Enforcement Act
EMA- Emergency Management Act
EO- Executive Order
EMPC Act- Emergency Management and Civil Protection Act
ESA- Endangered Species Act
FDR- Friends of the Detroit River
FIFRA- Federal Insecticide, Fungicide and Rodenticide Act
FL- Florida
FSA- Farm Services Agency
GIS- Geographic Information System
GISP- Global Invasive Species Programme
GLANSIS- Great Lakes Aquatic Nuisance Species Information System
GLBHI- Great Lakes Border Health Initiative
GLC- Great Lakes Commission
GLCFS- Great Lakes Coastal Forecasting System
GLERL- Great Lakes Environmental Research Laboratory
GLFC- Great Lakes Fishery Commission
GLIER- Great Lakes Institute for Environmental Research
GLFWC- Great Lakes Fish and Wildlife Commission
GLMRIS- Great Lakes Mississippi River Interbasin Study
GLNPO- Great Lakes National Program Office
GLRC- Great Lakes Regional Collaboration
GLRI- Great Lakes Restoration Initiative
GLSLCI- Great Lakes St. Lawrence Cities Initiative
GLTF- Great Lakes Task Force
GLU- Great Lakes United
GLWQA- Great Lakes Water Quality Agreement
HOW- Healing Our Waters Coalition
IAGLP- International Association of Great Lakes Ports
IAGLR- International Association for Great Lakes Research
IASPP- Invasive Alien Species Partnership Program
ICES- International Council for Exploration of the Sea
ICS- Incident Command System
IJC- International Joint Commission
IMO- International Maritime Organization
IN- Indiana
ISAC- Invasive Species Advisory Council
ISC- Invasive Species Council, Invasive Species Centre
JPAC- Joint Public Advisory Committee
km- kilometre
km^{2-} square kilometre

LCA- Lake Carriers Association
MARAD- Maritime Administration
MDA- Michigan Department of Agriculture
MDCH- Michigan Department of Community Health
MDEQ- Michigan Department of Environmental Quality
MDNR- Michigan Department of Natural Resources
MDNRE- Michigan Department of Natural Resources and Environment
MDOT- Michigan Department of Transportation
MEPC- Marine Environment Protection Committee
MHLTC- Ministry of Health and Long Term Care
MI- Michigan
MNR- Ontario Ministry of Natural Resources
MNRG- Midwest Natural Resources Group
MOE- Ontario Ministry of Environment
MOU- Memorandum of Understanding
MSG- Michigan Sea Grant
MTO- Ontario Ministry of Transportation
NAFTA- North American Free Trade Agreement
NAISA- National Aquatic Invasive Species Act
NANPCA- National Aquatic Nuisance Prevention and Control Act
NAS- Non-indigenous Aquatic Species
NCRAIS- National Center for Research on Aquatic Invasive Species
NEMWI- Northeast Midwest Institute
NEPA- National Environmental Policy Act
NGO- Non-governmental Organization
NISA- National Invasive Species Act
NISC- National Invasive Species Council
NMFS- National Marine Fisheries Service
NOAA- National Oceanic and Atmospheric Administration
NOBOB- No Ballast on Board
NOS- National Ocean Service
NPA- National Parks Act
NPA- National Parks Service
NRC- Natural Resources Canada
NRCS- Natural Resources Conservation Service
NSERC- National Sciences and Engineering Research Council
NWF- National Wildlife Federation
OFAH- Ontario Federation of Anglers and Hunters
OGL- Office of the Great Lakes
OH- Ohio
OISSP- Ontario Invasive Species Strategic Plan
OMAFRA- Ontario Ministry of Agriculture, Food and Rural Affairs
ON- Ontario
PAC- Public Advisory Committee
PCPA- Pest Control Products Act
RAP- Remedial Action Plan
SARA- Species at Risk Act, Superfund Amendment and Reauthorization Act
SCOPE- Scientific Committee on Problems of the Environment

SEMCOG- Southeast Michigan Council of Governments
SERC- Smithsonian Environmental Research Center
SLSA- St. Lawrence Seaway Authority
SLSDC- St. Lawrence Seaway Development Corporation
SOLEC- State of the Lakes Ecosystem Conference
SOP- Standard Operating Procedure
TC- Transport Canada
TNC- The Nature Conservancy
USCG- United States Coast Guard
UC- Unified Command
USACE- United States Army Corps of Engineers
USCG- United States Coast Guard
USDA- United States Department of Agriculture
USEPA- United States Environmental Protection Agency
USFWS- United States Fish and Wildlife Service
USGS- United States Geological Survey