The Great Lakes Water Quality Agreement

Promises to Keep; Challenges to Meet

Perspectives from Citizens

In Consultation With the Great Lakes Basin's Environmental Community
December 2006

Alliance for the Great Lakes
Ensuring a Living Resource for all Generations

Biodiversity Project
Life. Nature. You. Make the connection.

Canadian Environmental Law Association
L'Association canadienne du droit de l'environnement

Great Lakes United

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On the cover: Sand beach at Indiana Dunes National Lakeshore, Lake Michigan, Indiana

Photo: National Park Service, Indiana Dunes National Lakeshore, M. Woodbridge Williams

I. Executive Summary

In 2005 and 2006 the Alliance for the Great Lakes convened a dialog among leading Great Lakes nongovernmental policy groups (NGOs) in the Great Lakes region to identify key issues and recommendations for the current review of the Great Lakes Water Quality Agreement (Agreement), a pact the environmental NGOs have cared passionately about for decades. Four organizations formed the Project Team as co-equal partners: Alliance for the Great Lakes, Great Lakes United, Canadian Environmental Law Association and Biodiversity Project. Advisors from a variety of other organizations in the region participated in a series of exchanges through which team leaders drafted a set of guidance papers on major topics of concern. The guidance paper discussions and recommendations formed the basis for the recommendations in this report.

Section II of this report provides a brief description of the project and participants, with Section III covering an overview of this report.

Lake Superior's North Shore, Minnesota

Photo: Minnesota Extension Service, Dave Hansen

To understand the implications of this report, however, readers must understand the Agreement and its origins, covered under Section IV. The first Agreement, signed in 1972, was a response to a wave of scientific and public concern about phosphorus pollution and the "death" of Lake Erie. The 1978 Agreement was the first to embrace the "ecosystem approach" to Great Lakes water quality concerns. The 1987 Agreement Protocol spelled out new objectives for Areas of Concern and toxic air pollution, but also changed the institutional structures of the International Joint Commission (IJC) the joint U.S.-Canada body that advises the U.S. and Canada (the Parties) on trans-boundary matters. The current review is the first major review and potential revision of the Agreement since 1987, although there have been minor reviews in the intervening years. Now the Parties are likely to "review" the Agreement for possible changes. The purpose of this report is to give citizens from across the Great Lakes watershed (Basin) a voice as the next generation of the Agreement is considered.

In considering the current review, the Project Team identified historic core strengths of the Agreement. These include the common objectives shared by both nations, the IJC's independent role in gathering information and providing "early warnings" on threats to the Great Lakes, and the process and structures of the Agreement that have served as venues for public engagement and constituency building. The team also identified major concerns with the current state of the Agreement. These include the eroding bi-nationalism

and independent voice of Agreement institutions, a lack of accountability by the Parties, barriers to public involvement, and lack of leadership by the Parties to commit resources to meet Agreement objectives.

The report provides recommendations at two levels. Section V looks at recommendations on overarching principles that should guide the future spirit and overall thrust of the Agreement, urging that a future Agreement: 1) be more preventative in its ecosystem approach (i.e., embrace the precautionary principle), 2) more urgently compel ecological recovery, and 3) provide for more accountability for implementation. In summary, the Project Team recommends that the review of the pact should document and build upon the strengths of the existing Agreement and address challenges in achieving objectives. The review should be substantive and lay the groundwork for more than a simple tinkering exercise.

Following the guiding principles, Section VI examines a wide range of more specific "drivers" (causes) of water quality degradation in the Great Lakes Basin, and provides recommendations for 18 specific drivers under four major headings: Gaps in Pollution Prevention and Control; Ecological Stresses that Affect Water Quality; Gaps in Great Lakes Science; and Barriers to an Effective Public Role.

The pollution discussion gives particular emphasis to toxic pollution. General guidelines on toxic substances preface the section, reiterating the need for precaution and arguing for an improved system for assessing and managing toxic substances. The report then addresses specific sources of toxic pollution, which include sewage and sewage sludge, industrial point sources, airborne deposition, and contaminated sediments. The pollution discussion also examines stormwater runoff and sewage overflows, agricultural runoff and concentrated agricultural wastes, which are sources of both toxic and "conventional" pollutants.

Ecological stresses also affect water quality. The report considers the significant role that damaged habitat, invasive species and global warming are having (or are likely to have) on Great Lakes water quality, and recommends actions under the Agreement for each of these topics.

The Agreement has played a significant role in driving Great Lakes research and monitoring, and the report flags concerns about gaps in surveillance and monitoring programs, the slow pace of moving forward with indicators called for in 1987, and the need to improve research coordination and increase research funding.

The final set of recommendations focuses on the role of the public, and calls for provisions such as allowing citizens to petition for action under the Agreement, establishing a citizen advisory board, and more transparent reporting on the part of the governments.

As such, recommendations under Section VI's drivers are meant to give effect in tangible ways to Section V's guiding principle recommendations. By recommending guiding principles and specific ways to address particular threats, the Project Team seeks to ensure that Great Lakes health is not viewed merely as an aggregation of different threats. Rather, we believe—and this report illuminates—that the road to Great Lakes and human health must be viewed holistically. After all, the Great Lakes ecosystem is more than a sum of its parts.

II. Project Purposes and Goals

The environmental community in the Great Lakes region has had a long, proud history with the Agreement. When first proposed by the governments in the early 1970s to merely include the bi-national Great Lakes, the environmental nongovernmental organizations (NGOs) spoke up to ensure that Lake Michigan—wholly within U.S. borders—would also be covered by the Agreement. And, they won. Ever since, they've played a vibrant role in this precedent-setting pact.

With the Parties soon to consider the future of the Agreement, the Alliance for the Great Lakes, Biodiversity Project, Canadian Environmental Law Association, and Great Lakes United received a generous grant from The Joyce Foundation with one purpose in mind: to coalesce the region's advocates behind a unified set of recommendations for the next generation of the Agreement. The purpose of this report is to articulate that unified position.

Project Team and Participants

The Project Team for this effort consists of the Alliance for the Great Lakes, Biodiversity Project, Canadian Environmental Law Association, and Great Lakes United. The Project Team's primary authors for this report were: Hugh Benevides, Cameron Davis, Fe de Leon, Reg Gilbert, John Jackson, Jennifer Nalbone, Jeff Potter, Derek Stack, and Paige Wilder.

Silver water lapping at beach, Lake Michigan Tawas Pt. State Park, Michigan

Photo: Michigan Sea Grant Extension, Carol Y. Swinehart

The Project Team also thanks the National Wildlife Federation's Great Lakes Natural Resource Center and Sierra Club's Great Lakes Program for their counsel as official observers to the Agreement's 1987 Protocol process.

So as to ensure that this project and report could take into account a wide array of opinions, the Project Team relied heavily on the views of an Advisory Committee consisting of: Luc Bergeron, Lee Botts, Andy Buchsbaum, Lynn Katz Chary, Tim Eder, Jane Elder, Tom Daggett, Mike Gilbertson, Emily Green, John Jackson, John Mills, Grenetta Thomassey.

We would also like to acknowledge the following participants, who provided their energy, intellect, and passion for the Great Lakes by voicing their thoughts for policy positions that this report should include: Olivia Arditi, Ian Attridge, Marilyn Baxter, Brian Beauchamp, Al Beeton, Hugh Benevides, Sandy Bihn, Lee Botts, Joel Brammeier, Steve Brandt, Ian Bruce, Mark Burrows, Pat Canada, Allegra Cangelosi, Maureen Carter-Whitney, Lin Chary, Quentin Chiotti, Nancy Cole, Derek Coronado, Kay Cumbow, Cameron Davis, Tom Dietz, Fe de Leon, John Dettling, Keith Dimoff, Leslie Dorworth, Tracey Easthope, Tim Eder, Vern Edwards, Rick

Findlay, Henry Henderson, David Gard, Roger Gauthier, Reg Gilbert, Judy Gordon, Emily Green, Charles Griffith, Lino Grima, Wayne Groesbeck, J. Drake Hamilton, Moyra Haney, Victoria Harris, Tom Hersey, Alice Hirt, Rita Jack, John Jackson, Kevin Kamps, Mike Keegan, Thomas Keegan, John Kennedy, Manfred Koechlin, David Konkle, Paul Kostyniak, Gail Krantzberg, Karen Nadder Lago, Peter Landrum, Lucie Lavoie, John Lenters, Brennain Lloyd, Chad Lord, Pat Lupo, Jack Manno, Ann McCabe, Elaine McDonald, Jennifer McKay, Kay McKenzie, Kevin Mercer, Ed Michael, Sarah Miller, Terry Miller, John Mills, John Morand, Lois Morrison, Linda Mortsch, Giorgos Mountrakis, Paul Muldoon, Joy Mulinex, Michael Murray, Jennifer Nalbone, Melanie Napoleon, Patty O'Donnell, Kris Olsson, Jeff Potter, Frank Quinn, David Ramsay, Keith Reopelle, Jeffrey Reutter, Mark Richardson, Michelle Hurd Riddick, Cyndi Roper, Gary Rose, Abby Rubley, Jill Ryan, Dana Schindler, Richard Schraven, Melissa Shaffer-Oconnell, Heather Smith, Christine Soliva, Derek Stack, John Taylor, Grenetta Thomassey, Gildo Tori, John Trimberger, Ray Vaughn, Rimma Vedom, Anthony Vodacek, Paige Wilder, Gary Wilson, Kim Winchell, Sarah Winterton, Robert Wright.

As dozens of individuals were involved in voicing their thoughts on the future of the Great Lakes Water Quality Agreement, the Project Team apologizes for any exclusions or oversights in the above lists.

Key Topics

The Project Team "cast a wide net" in scoping issues for possible consideration in a future iteration of the Agreement. We explicitly rejected one issue area for inclusion in this report: hydrology. The rationale for this was that, despite the impact that flows and water quantity can have on water quality, the states and provinces in 2005 proposed a Great Lakes Water Resources Compact and a corresponding "Agreement." While the central purpose of the Compact and Agreement were not to protect water quality, but to provide decision making standards for water withdrawals, we believed that a Great Lakes Water Quality Agreement need not duplicate this effort. Any exclusion of issues in this report are not indicative of the Project Team's wish for such issues to be included or excluded in the future.

III. Introduction

In 1972 the United States and Canada forged the Great Lakes Water Quality Agreement to protect and restore the waters of the Great Lakes—one of the world's most important freshwater ecosystems. The Agreement has been characterized as one of the most forward-thinking diplomatic achievements for the environment in modern times, and it has served as a model for other international agreements to protect and restore environments elsewhere in the world. Its strengths include a structure and process that place the focus on strategies for restoring and protecting the ecosystem, rather than achieving national agendas. It established the lakes as a shared "commons" of two great nations (as well as many other jurisdictions), and the two nations as the jointly responsible stewards of this treasure.

Since 1972 the Agreement has been reviewed and revised several times. Once again, the nations are reviewing it for a new stage of possible revisions. Since its inception, many promises of the Agreement have been fulfilled, and many have not. The task of meeting the objectives falls to the governments and agencies of each nation, and over the last several decades, these commitments have sometimes been pursued zealously, and sometimes left to languish.

Sand blowing on beach near Oscoda, Lake Huron, Michigan

Photo: Michigan Sea Grant Extension, Carol Y. Swinehart

As the people of the United States and Canada engage in a new consideration of the goals, objectives, and structures of this landmark pact, Great Lakes citizens' organizations have initiated their own review and assessment of the Agreement and its future role. A thorough review requires a careful and iterative process. This report is a first stage in what we envision as an open and rigorous citizen's dialogue on the Agreement. As such, this is not a comprehensive review, nor a comprehensive set of recommendations, but an initial statement of principles, concerns and recommendations that we hope will inform the evolving review process and subsequent action on the Agreement by the Parties.

We share concerns regarding potential revisions of the Agreement. In brief, we believe it imperative to:

- Reaffirm the fundamental goals of the Agreement "to restore and maintain the chemical, physical and biological integrity of the Great Lakes ecosystem" and prevent backsliding on targets such as "virtual elimination of toxic substances."
- Ensure that the Agreement responds to the ecological changes and emerging stresses to the ecosystem as they pertain to the water quality in the Great Lakes.
- Ensure that the Agreement addresses water quality from the

standpoint of protecting human health and public safety, but also that of health and productivity of native Great Lakes fish, wildlife and other organisms.

- Establish mechanisms to ensure compliance with the Agreement by the governments of the United States and Canada to honor the commitments of our leaders and protect the health and natural resources of our peoples.
- Reaffirm the binational spirit, philosophy and implementation of the Agreement—that the ecosystem is a shared responsibility of two nations working in cooperation to safeguard a treasure held in common trust, and that both nations have equal standing in the eyes of the Agreement.

This report is designed to build the case for these conclusions through providing the following:

- An overview of the history and context of the Great Lakes Water Quality Agreement;
- Guiding principles for the review process and the Agreement;
- A discussion of major drivers of water quality degradation and recommendations for addressing these drivers through the Agreement.

The primary drivers we address are:

- Gaps in Pollution Control and Prevention;
- Ecological Stresses that degrade Water Quality;
- Gaps in Great Lakes Science; and
- Barriers to an Effective Public Role.

IV. History and Context

The Call for Action

In the late 1960s the Great Lakes were in serious trouble. Lake Erie was choked with algae, oxygen-starved, and declared "dead" in the popular press. Masses of dead alewives had been washing up on Lake Michigan beaches, and pollution was widespread in many other parts of the Great Lakes system. When the oil and chemical slick on the Cuyahoga River burst into flames, it was a signal fire for public response.

Whether it was the flaming Cuyahoga or the cumulative effect of the loss of so much of what we value about the lakes, people had just plain had enough. A public outcry rose in both the United States and Canada, part of the rising tide of environmental awareness and activism that spawned a new era of legal and regulatory responses.

The International Joint Commission and the Boundary Waters Treaty

The International Joint Commission (IJC) is an agency established under the 1909 Boundary Waters Treaty to provide a structure through which the United States and Canada could deal with rights and uses in waterways that form or cross their common boundary. At the direction of Canada and the United States, the IJC developed the framework for the first Great Lakes Water Quality Agreement in response to concern about oxygen-depleting eutrophication, pollution, and the rising public demand for action to address these and other threats to the Great Lakes. Following two years of intense negotiations, Richard Nixon and Pierre Trudeau signed the first Agreement in 1972, under the authority of the Boundary Waters Treaty.

Chequamegon Bay, Lake Superior, Wisconsin

Photo: US Environmental Protection Agency, Karen Rodriguez

The Agreement is an "executive agreement" between two sovereign nations. The U.S. Senate did not ratify the Agreement (a process that applies to treaties), which led to ambiguity about its enforceability under domestic law. Likewise, the Canadian government did not adopt legislation specific to the Agreement as it did when it passed the Boundary Waters Treaty Implementation Act.

The IJC has no formal regulatory or enforcement powers under the Agreement, but it does have authority for oversight and monitoring progress toward achieving objectives by the United States and Canada. Both governments committed to the terms of the Agreement and accepted responsibility to honor it. The Parties (the governments) carry the responsibility for compliance. The relative roles and responsibilities of federal, state/provincial and local governments were left to each nation to determine, and this has been a significant factor in failures to achieve objectives, because

these responsibilities are not clearly delineated. In Canada, however, successive Canada-Ontario Agreements have helped clarify the division of roles.

The 1972 Agreement: Tackling Phosphates and Filth

The main goal of the 1972 Agreement was to reduce the phosphorus levels that were causing the eutrophication problems in Lake Erie and degraded areas elsewhere in the Great Lakes. The Agreement was set up to address these and related issues in the main body of the text (the articles) through establishing water quality goals and objectives and delineating institutional roles and relationships. These roles included that of the IJC, under which it established a Water Quality Board and a research board, which later became known as the Science Advisory Board. The Agreement also contains specific annexes, which address specific issues.

Actions to clean up the Great Lakes following the 1972 Agreement are considered one of the great success stories in Great Lakes protection. New policies, such as the U.S. Clean Water Act and major Canadian investments in sewage infrastructure helped underpin the Agreement, and led to rapid improvements in sewage treatment, as did bans on phosphate detergents, and reductions in agricultural runoff. The algae began to go away, and so did the floating filth. Fish kills disappeared and water quality improved rapidly, especially in Lake Erie. The walleye began a robust recovery. By the mid-1970s, people were beginning to declare "victory" on the eutrophication front.

Yet, during this hopeful time, scientists were finding mounting evidence of a different kind of problem—toxic chemicals in the food web. The information gathering and investigative role of the IJC shone during this era. IJC-directed research identified the link between atmospheric transport and bioaccumulation in the ecosystem when PCBs were discovered in lake trout samples on Isle Royale's inland Siskiwit Lake. It became clear that inputs from the atmosphere, land-runoff, and old contaminated sites were a major part of a different water quality puzzle in the Great Lakes. The manufacture of PCBs was banned in the United States in 1977 under the new Toxic Substances Control Act (TSCA). Canada also banned PCBs that year. Domestic legal mechanisms such as the U.S. Clean Water Act, and TSCA provided an enforceable tool to achieve Agreement objectives.

The 1978 Agreement: Ecosystem Approach and "Zero Discharge"

The first Agreement focused primarily on water chemistry and pollution. The second generation of the Agreement was negotiated in 1978 with a bolder and broader mission: "To restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes Basin Ecosystem." If the 1972 Agreement provided the springboard for dramatic phosphorus reductions, the 1978 Agreement provided the platform for new strategies to address toxic chemicals.

The two significant shifts of the 1978 Agreement were the "ecosystem approach"—the notion of taking the whole ecosystem into account (and not just the parts) and the call for "virtual elimination" of toxic pollution, which Annex 12 described as "zero discharge" of toxic pollutants. The Agreement requires that: "The discharge of toxic substances in toxic amounts be prohibited and the discharge of any or all persistent toxic substances be virtually eliminated." A third significant change was the Agreement's embrace of wildlife and ecological health in addition to—or as an indicator of—human health.

The 1987 Protocol and Beyond: Tackling Toxic Sources, Changing Institutional Roles

When the Parties undertook a review in 1986 to consider whether the pact needed to be changed, there was general agreement not to open the full Agreement to renegotiation, in part due to concerns that some of its terms might be rolled back. Instead, the Parties sought to provide a mechanism to amend and add to it, without placing the full document on the negotiating table. The Parties established a process for a "Protocol" instead, which meant that there would be very few changes in the body of the articles, but significant additions through annexes.

Within the 1987 Protocol, one key change was institutional: the two governments sought to meet together and exchange information directly, instead of reporting progress directly to the IJC. They also established processes for Lakewide Management Plans (for each lake) and Remedial Action Plans (designed to engage citizens and local governments in cleaning up newly named toxic hotspot "Areas of Concern") to restore water quality and rapidly ratchet down the levels of toxic pollutants in the lake ecosystem. Environmental advocates successfully pushed to address the multiple inputs of toxic chemicals into the Great Lakes foodweb through addition of annexes on contaminated harbor sediments and atmospheric inputs.

During this same period, federal environmental strategies in both nations were shifting, driven in part by philosophies of deregulation and cuts in regulatory staff and enforcement programs. Advocacy strategies shifted from pushing for environmental protection to defensive "anti-backsliding" positions. Resistance to tackling the Agreement objectives by U.S. EPA headquarters drove U.S. advocates to seek amendments to the 1987 Clean Water Act that included language about the Agreement. A few years later, with little evidence of progress, Congress sought a second remedy through establishing the 1990 Great Lakes Critical Program Act, which passed as an amendment to the U.S. Clean Water Act. In Canada, environmental groups succeeded in inserting "virtual elimination" into the Canadian Environmental Protection Act (CEPA).

Though in 1987 the federal environmental agencies (Environment Canada and U.S. EPA) had set themselves up ostensibly for a larger role in the Agreement, in fact, their budgets and inclination to fulfill this mission were eroding. At the same time, the gravitas and structures of the IJC had been undermined through significant cutbacks in staff and resources and by establishing structures that largely bypassed the existing boards. The combination was devastating to progress under the Agreement.

The IJC's public meetings—held biennially—became a forum through which continued citizen concerns about toxics in the Great Lakes systems were raised. Some found this use of the meetings an appropriate arena for the expression of public concern, and others found it to be "a circus." Beginning in 1995, the IJC changed the structure and process of the biennial meetings to avoid providing a forum for this public outcry. While limited progress was made on addressing concerns about toxic pollution, the Great Lakes were facing a new wave of threats, exemplified by the explosion of zebra mussel populations, and increasing losses of habitat and biodiversity in the region.

One result of the curtailed functions of the IJC has been the absence of comprehensive data or reports from United States or Canada since the early 1990s that document the true state of the Great Lakes. The lack of such valuable information, which was produced historically by the IJC, left the public and policy makers alike with the impression that active intervention in Great Lakes management was not critical.

1998–1999 Review

In the early 1990s the Parties had established the Binational Executive Committee (BEC) as an alternative coordinating struc-

ture led by the regional administrators of both nations' environmental agencies and populated it with representatives from the various environmental departments within the federal, provincial and state governments. The next periodic review of the Agreement was slated for 1998 and a "Binational Steering Committee" was formed to provide initial guidance to the BEC. The committee concluded that many Agreement annexes were out of date and changes were needed in other areas. There was concern within the NGO community that renegotiation at this stage would lead to weaker terms and further dilute agency actions to achieve objectives. Largely as a result of NGO pressure, in 2000, the BEC co-chairs announced that the Parties would not pursue a renegotiation of the Agreement.

Other events unfolded. Also in 2000, water contamination in Walkerton, Ontario led to seven deaths and another 2,000 people becoming seriously ill. This tragedy led to a new focus on water quality issues in Ontario and Canada, including the passage of Ontario's Safe Drinking Water Act and a new focus on watershed planning.

The NGOs, led by the Alliance for the Great Lakes (then the Lake Michigan Federation), Sierra Club, Great Lakes United as well as the Council of Great Lakes Industries successfully pressed for passage of the Great Lakes Legacy Act in 2002 to provide funding for contaminated sediment cleanup. In Canada, the federal and provincial governments established an internal agreement—The Canada-Ontario Agreement (COA)—to clarify roles for achieving Agreement objectives within the Great Lakes ecosystem Basin. COA has undergone several reviews and revisions but remains the main vehicle for implementing the Agreement in Canada. By early 2003 there was growing agreement that a new comprehensive review of the Agreement was called for.

On a parallel but separate path, in 2003 the U.S. General Accounting Office released a report criticizing the lack of coordination among the multiple agencies with Great Lakes responsibilities. It called for a comprehensive strategy to restore the Great Lakes. Also in 2003, legislation was introduced in both the U.S. House of Representatives and Senate calling for a new comprehensive Great Lakes "restoration" effort. In 2004 President Bush issued an executive order to create another Great Lakes plan through a U.S. federal inter-agency task force, which spawned the Great Lakes Regional Collaboration Strategy (Strategy)—a multi-stakeholder action plan led by mayors, governors, tribes, and civic leaders—in 2005. These policies were not formally linked to the

Agreement, but have the potential to lay the groundwork for significant progress on objectives. Congress introduced legislation in 2006 and is expected to do so again in the future to help fund the Strategy. As of the release of this report, Canada has produced no similar plan.

In addition, the states and provinces had been considering a separate new compact for hydrological health since 2001, (the Great Lakes Water Resources Compact), which was signed by the Governors and Premiers of the Great Lakes states and provinces in late 2005.

In January of 2005 a proposed process for the Agreement review was released for public comment, and the formal review began in the spring of 2006.

The Health of Lakes in the Face of a New Review

With a formal review in process, we find today's lakes facing a declining, but still significant burden of toxic chemicals. Only three of the 42 "hot spots" have been removed from the list of Areas of Concern since their listing in 1987. Over the last two decades the Parties have made only limited progress on curtailing atmospheric inputs of toxic chemicals to the system—most notably mercury. As a result, much of the Great Lakes fishery remains highly restricted for consumption by children and women who hope to bear children nearly 20 years after a concerted call for virtual elimination of toxic pollution in the Great Lakes.

Great Lakes fish are contaminated, and many populations are unstable due to disruptions in the foodweb and reproductive failures. Environment Canada documents the following results from the impacts of chemicals in the Great Lakes: "various species of fish now suffer from tumours and lesions, and their reproductive capacities are decreasing. Populations of fish consuming birds and mammals also seem to be on the decline. Of the ten most highly valued species of fish in Lake Ontario, seven have now almost totally vanished."[1]

Historic victories, such as the restoration of Lake Erie, are eroding. The oxygen depleted "dead zone" is back in the western Lake Erie Basin. At the same time sewage overflows are frequent and commonplace in many municipal systems throughout the Great Lakes and raw sewage remains a threat to water quality.

A new wave of emerging threats also requires our attention. These include:

- The upheavals in biological systems and water chemistry caused

by a growing onslaught of invasive species, including a "biological desert" expanding across portions of southern Lake Michigan;

- A new wave of known and potential toxic chemicals documented in fish and Great Lakes sediments, including the fire retardants, polybrominated dephenyl ethers (PBDEs), and a brew of pharmaceutical and cosmetic compounds with unknown effects;
- Increasing incidents of "stinking algae" washing up on Great Lakes beaches during warm summer months;
- Botulism outbreaks in Lake Erie fish and birds; and
- Impacts on water temperature and water levels from global warming.

Strengths of the Agreement

The Agreement was a pivotal catalyst for actions to reduce phosphorus levels and the first wave of efforts to control, reduce and eliminate toxic substances in the Great Lakes. These achievements were grounded in the core strengths of the Agreement, and these key elements of past successes should be considered in deciding how to address new challenges. Likewise, these catalytic functions have the potential to renew binational Great Lakes recovery efforts.

1. Shared objectives

As the IJC Web site states, "The Agreement…expresses the commitment of each country to restore and maintain the chemical, physical and biological integrity of the Great Lakes Basin ecosystem and includes a number of objectives and guidelines to achieve these goals. It reaffirms the rights and obligation of Canada and the United States under the Boundary Waters Treaty and has become a major focus of Commission activity."

A shared affirmation by two sovereign nations of their intent to protect the ecosystem is a significant democratic tool. The common goals and objectives channel the activities of multiple jurisdictions toward common ends—a remarkable achievement in a watershed reaching across 300,000 square miles and home to some 42 million people. The common objectives also serve as a standard for achievement regardless of changing administrations on either side of the border, and provide benchmarks for assessing progress. They also formally acknowledge that neither nation can protect the lakes on its own—this is a shared opportunity and obligation.

2. Information Gathering, Monitoring and Early Warning System

Historically, the IJC has played a unique and important role in information gathering, fact-finding, and assessing information about the state of the lakes. The Science Advisory Board provided a structure for objectivity and neutrality in research and analysis where the key factor was the light that research would shed on the lakes, not on how the information might affect the agendas of the interests of any nation, agency or sector. The IJC also served as a center for collecting a wide range of lake-related information, serving as something of a "brain trust" for scientific and technical knowledge about the Lakes and providing a nexus for a unique community of experts across multiple fields.

The iterative and adaptive nature of the charge under which knowledge was gathered fostered new inquiry into emerging threats, not just static monitoring for known concerns. As a result, reports from the IJC's boards have served as early warning tools for emerging threats and as a means to focus the attention of the scientific community, the region's agencies, and the two national governments.

3. Accountability and a Forum for Galvanizing Public Will

Biennial meetings and the IJC's reporting process provide a mechanism for public accountability of the Parties' commitments and capabilities. The reports require an assessment of progress on achieving objectives, and serve as a tool for evaluating the efficacy of strategies. The Agreement has also served informally to build a constituency of informed and concerned individuals, agencies and organizations that form a binational community of stewardship for the Great Lakes, bound by a common concern for the ecosystem and minimally influenced by one's nation of origin. This is a significant asset for protecting and restoring Great Lakes water quality, and an essential component of democratic response and action.

Concerns about Agreement Institutions and Governance

The Agreement has often been cited as a model to the rest of the world for peaceful management of an expansive ecosystem across national boundaries. The current binational governance system, however, has diverse institutions with different missions that confuse citizens and legislators in their competition for attention and resources. The need for a holistic ecosystem approach to management was first identified in the 1978 Agreement, and many

forums since. Likewise, clarity in accountability for the failure of the Parties to live up to commitments or to take prescribed actions under the Agreement is muddied by the multiple layers of governance and increasing lack of transparency in decision-making.

Binational Institutions

The changing roles of binational institutions following the 1987 Protocol has increased the confusion as to where responsibility lies for dealing with systemic Great Lakes issues, and diluted the historic independent voice of the IJC. Over the same period, efforts to make progress on Agreement objectives have been subjected to shrinking resources for the functions and activities of the IJC and cutbacks in resources for environmental enforcement and research on both sides of the border. Moreover, the strengths of the binational institutions such as the IJC have been further eroded by the politicization of the commissioner appointment process. Meanwhile, old issues, such as toxic pollution remain unresolved and progress on plans such as "RAPs" is painfully slow, while new issues, such as invasive species add to the complexities that marginally functional institutions are expected to address.

There is general consensus among NGOs that the Agreement is a fundamentally sound document. What is not sound is the structure and processes by which institutions and mechanisms are meant to implement it.

In their book, *Evolution of the Great Lakes Water Quality Agreement*,[2] authors Paul Muldoon and Lee Botts urge the following criteria for assessing the role of joint institutions and their role in achieving the objectives of the Agreement:

- Will the governments rely on the Agreement institutions as being credible and effective?
- Will these institutions have the mandate and terms of reference to assess both the conditions of the Great Lakes and the programs of the governments?
- Will the public view the institutions as credible and effective and will representatives of the public have a meaningful role in them?
- Does a given institution duplicate or compete with existing institutions, and is it truly needed?
- Is the institutional arrangement efficient? Does this arrangement improve communication between the lead federal agencies and state, provincial and local governments?

Accountability of the Parties

Those who sign the Agreement are also obliged to meet its terms, but both nations have fallen far short on implementation since 1987. A renewed Agreement will only be meaningful if the United States and Canada bring their political will, strength of their domestic law (including oversight processes as well as penalties and sanctions for failing to achieve objectives), and financial resources to the table with them. In addition, roles and responsibilities between various levels of government within each nation must be clearly delineated to determine which agencies and governments carry responsibility and accountability for achieving objectives. (Canada's Canada-Ontario Agreement provides one example.)

Public transparency and citizen participation

Transparency in decision-making and institutional processes is essential, as is an active role for citizens in framing the Agreement and in monitoring progress toward achieving its objectives. Involved citizens become a constituency, which is the foundation of expressed public will. Public will is the key ingredient for long-term protection and restoration of Great Lakes water quality. (Specific recommendations for citizen participation are provided in section VI under topics 17 and 18.)

Our recommendations for the review and potential renewal of the Agreement are based on the premise that the Great Lakes require a strong and clear statement of shared objectives to restore and protect water quality. Likewise, the Great Lakes require equally strong institutions and clear democratic processes to implement those objectives.

Leadership by the Parties

As mentioned earlier in this report, the Parties must make a concerted effort to rehabilitate the Great Lakes in two ways. First they must establish, execute, and track programs under quantifiable restoration deliverables. Second, they must make ample investments to underwrite such activities. In the United States, mayors, governors, congressional leaders, tribal leaders, and civic leaders endorsed a Great Lakes Regional Collaboration Strategy to identify such activities and have supported comprehensive legislation to provide billions of dollars for those activities. Likewise, the establishment of such efforts and investments in Canada is necessary. Ecosystem recovery must take place on both sides of the border for the Great Lakes-St. Lawrence River system to benefit.

V. Guiding Principles

Great Lakes citizen organizations recommend three broad principles to guide the review of the substance and strategic thrust of the current Agreement (and any consideration of renewing, revitalizing or changing the Agreement.) We also recommend a set of specific rationales and actions for the review process.

Recommended Principles

A. Be Preventative in its Ecosystem Approach

To build upon the emerging successes of the Agreement's call for the "zero discharge" and "virtual elimination" of persistent bioaccumulative toxic pollutants, and to continue to serve as a catalyst for water quality improvements, the Agreement must proactively identify and eliminate threats to the physical, chemical, and biological attributes of water quality before they become manifested problems. To embrace and implement the precautionary approach several practices should be embedded in the Agreement:

- Preemptively identifying threats;
- Taking preventive action in the face of uncertainty;
- Shifting the burden of proof of safety to the proponents of an activity;
- Exploring a wide range of alternatives to possibly harmful actions; and
- Increasing public participation in decision-making and providing more effective means of participation.[3]

Lake Michigan beach, Petoskey, Michigan
Photo: Michigan Travel Bureau

B. Compel Ecological Recovery in its Ecosystem Approach

Simply preventing new problems will not ensure the ecological integrity of the Great Lakes ecosystem. Following the call for contaminated sediment cleanup in Areas of Concern, for example, the Agreement must take the next step in rehabilitating the Great Lakes-St. Lawrence River ecosystem from the effects of existing problems that jeopardize water quality on both sides of the border. This means more than just "cleanup," however. Recovery can include the rehabilitation of habitat such as wetlands to aid in the reduction of polluted runoff.[4]

C. Provide for Implementation with Public Accountability

The Agreement and its institutions are only as effective as the check and balance assurances that its obligations will be executed. As such, implementation of its goals and objectives must be dele-

gated to specific institutions or agencies. Milestones and benchmarks must be provided to ensure that ultimate goals and objectives are met within established timeframes. The Agreement's emphasis must be on achieving end goals. However, watershed planning, materials use policies, and toxic use reduction policies (all of which should include timeframes) should be encouraged for adoption by the Parties as a possible means to ensure that responsible agencies are making progress. Flexibility for such planning and milestones would be important for the Parties to be able to achieve end goals and objectives in the manner most fitting for their own jurisdictions.

As a general proposition, goals and objectives with timeframes should be set by the Parties. The IJC should then evaluate progress.

To aid in this process, we strongly recommend that the next generation of the Agreement be "outcome based." In other words, using existing reports and data, we recommend that the Agreement articulate quantifiable, measurable ecosystem outcomes (e.g. number of wetland acres to be restored to improve water quality, or reductions in specific toxic chemicals to restore the sustained natural reproduction of lake trout in Lake Michigan by a certain date) and identifying specific Parties accountable for that work. This recommendation stems from the concern that planning (e.g. Remedial Action Plans, Lakewide Management Plans, etc.), while important, should be the means to achieve quantifiable ecosystem ends. Yet, since 1987, much attention has been spent on developing and refining plans and progress reports without commensurate attention on ensuring that the activities in such reports and plans are carried out.

Recommended Processes

We believe the Agreement and its implementation must be significantly changed for several reasons:

The Agreement must take into account emerging threats and undo past harm, the new manifestations of which have only come into view since the Agreement's annexes were last revised in 1987.

The Agreement, once a strong rallying point for residents of the Basin, has not been a significant driver of water quality improvement in recent years. For the Agreement to remain alive or more important, to once again lead to "cutting edge" change, it must be revived and reinvigorated. Moreover, the Parties themselves must embrace accountability measures, not undermine or resist them as they have done in the past.

Assess Institutional Roles and Responsibilities

This review should document and build upon the strengths of the existing Agreement and address challenges in achieving objectives, but should be used neither as a platform for scrapping it, nor for conducting a wholesale rewrite. The review should also be substantive, and lay the groundwork for more than a simple tinkering exercise.

In addition, enhancing the effectiveness of the Agreement is critical, as is assessing the capabilities and performance of the institutions charged with its development, implementation, and evaluation. This institutional assessment is essential to ensure effective implementation of the Agreement. The review should assess the factors that have weakened the implementation of the Agreement and make recommendations on how to overcome these problems. This should include a review of the roles of the various institutions and how they can avoid the duplication of effort or maximize their strengths. For example, how can the IJC best relate to Commission for Environmental Cooperation under the North American Free Trade Agreement? The Great Lakes Fishery Commission? Tribes and First Nations? How can better cooperation among these governments be facilitated?

Public Participation

The public must also have a strong role in the development and assessment of the Agreement's effectiveness. We recommend that citizens be appointed to participate in all stages of any formal review (including scoping, preparation of background documents and the review itself) as well as any revision, renewal, or renegotiation process. Precedent for this was established in the 1980s leading to the addition of the Agreement's 1987 Protocol. The Parties need to make a concerted commitment to support effective citizen engagement.

Geographic and Ecological Scope

Finally, for a true "ecosystem approach" to work, the scope covered by the Agreement must include the Great Lakes and the St. Lawrence River Basin. This also means that all threats to water quality must be addressed through the Agreement, even those threats that are generated outside of the Great Lakes Basin, such as global warming.

VI. Drivers of Degradation, Recommendations for Action

This section provides an overview of major topics of concern related to the Agreement review and renegotiation. It also includes recommendations for responsive action to address specific conditions and practices that continue to drive degradation of water quality in the Great Lakes ecosystem. The discussion is structured under four major conceptual areas. Specific topics are numbered sequentially through the text. The four areas and specific topics are organized as follows.

A. Gaps in Pollution Prevention and Control

1. Toxic Chemicals: the need for an overarching strategy
2. The Need to Establish Stronger Systems for Assessing and Triggering Action on Toxics
3. Sewage as a Source of Toxic Chemicals
4. Sewage Treatment Plants as a Source of Pharmaceutical Pollution and Endocrine Disruptors
5. Land Application of Sewage Sludge as a Source of Contaminants
6. Industrial "Point" Discharges as Sources of Toxic Pollution
7. Airborne Sources of Toxic Pollution
8. Contaminated Sediments: Cleaning Up the Languishing Toxic Legacy
9. Stormwater Runoff and Sewage Overflows: A Continuing Source of Nutrient and Pathogen pollution
10. Agricultural Runoff and Concentrated Wastes

B. Mounting Ecological Stresses that Affect Water Quality

11. Habitat Loss and Degradation
12. The Onslaught of Aquatic Invasive Species
13. Anticipating the Impacts of Global Warming

C. Gaps in Great Lakes Science

14. Monitoring
15. Indicators
16. Research

D. Barriers to an Effective Public Role

17. Democratic Processes to Promote Enforceability and Compliance
18. Citizen Participation

Sunset over Lake Erie
Put-in-Bay Harbor, Ohio
National Park Service, Perry's Victory and International Peace Memorial

A. Gaps in Pollution Prevention and Control

This section discusses pollution prevention and control in two major areas. The first discussion focuses on toxic pollution, beginning with an overview of general guidance for strategies and approaches under the Agreement, followed by a source-by-source review of toxic pollution vectors. The second discussion focuses on other forms of pollution, such as nutrients, bacteria and sedimentation. Recommendations related to the Agreement follow each topic.

1. Toxic Chemicals: The need for an overarching strategy

In spite of calls for the virtual elimination of sources of toxic substances, every day new (and often legally permitted) pollutants continue to pour, trickle, rain, and leach into the Great Lakes ecosystem. Sewage systems, industrial discharge, urban and agricultural runoff, airborne deposition, and leachate from contaminated sites all contribute to the pollution load in Great Lakes waters and the food web. Lake sediments in at least 39 sites in the Basin are contaminated with heavy loads of persistent toxic chemicals that remain a significant threat to human health and ecological recovery. In addition, thousands of unregulated new substances continue to be introduced by new industrial processes and pharmaceutical advances—substances whose characteristics and effects in the environment are largely unknown.

Progress on managing toxic pollution has been hampered by lack of concerted action to anticipate and prevent harm (e.g. application of the precautionary approach). Other challenges include inadequate funding by both governments for programs to control, eliminate, or prevent the introduction of toxic substances, inadequate binational mechanisms to set shared priorities for action and limits in the state of research, data management, and information sharing among the institutions and jurisdictions. These gaps are further exacerbated because the Parties lack mechanisms to track progress and report on the effectiveness of prevention and control programs that exist in the Great Lakes Basin.

For example, the inherent limitation on effectiveness of the existing Binational Toxics Strategy (BTS) has been the preference for voluntary approaches. While "Canada and the United States are free at all times to take actions and pursue targets more stringent than those identified in this Strategy", Environment Canada and U.S. EPA have also expressly agreed to "collaborate in, and support voluntary initiatives by major use and

release sectors and others to reduce and eventually eliminate the use, generation or release of Strategy substances."[5] A stronger and explicit commitment to the use of enforceable regulatory tools is necessary if virtual elimination is to be achieved.

The NGO organizations participating in this review are calling for an overarching strategy to guide toxic substance control and prevention in the Great Lakes.

Recommendation

Overarching Goals and Strategies for Toxic Substances

1.a. The governments of Canada and the United States should re-commit their support for the goals of virtual elimination of persistent toxic substances and the Annex 12 goal of zero discharge.

1.b. The scope of these goals must be broadened to include substances other than persistent and bioaccumulative harmful pollutants including those that are carcinogenic, mutagenic, endocrine disrupting, or toxic to the neurological and reproductive systems.

1.c. Greater effort is required in addressing all sources of toxic pollution, with an emphasis on avoidance of the use of toxic substances through prevention, and substitution with safer alternatives.

Guiding Principles

Because the history of pollution in the Great Lakes is one of late reaction to problems, even in the face of evident harm, careful adherence to the overall guiding principle of precaution is particularly critical for toxic substances. So too, is shifting the burden of proof of ensuring safety to the producer, and maintaining public transparency as discussed previously. In addition we also recommend that the Agreement should adopt and incorporate the following principles and concepts:

♦ Recognition of unique exposure of children and other vulnerable communities to toxic substances;

♦ Pollution prevention and toxic use reduction and elimination requirements, including requiring product and process design those results in the reduction or elimination in the use and generation of toxic substances.

2. The Need to Establish Stronger Systems for Screening, Assessing and Triggering Action on Toxics

In Canada alone, approximately 23,000 substances that were imported or manufactured in Canada prior to 1986 have not been fully assessed. Under the Canadian Environmental Protection Act (CEPA) these 23,000 substances must be categorized to determine which need further government action. As a result of this process, 4,000 substances should qualify for further government attention, approximately 400 of which are thought to be persistent, bioaccumulative and inherently toxic. Industries that introduce "new" substances (that is, distinct from the 23,000) are required to submit limited data before the substance is allowed to enter the Canadian market. Canada faces a significant challenge in developing a plan to act on the 4,000 substances identified in categorization, as well as preventing pollution by new substances.

In the United States the Toxic Substances Control Act (TSCA) has systems for assessing and regulating new substances, but the law has been underutilized and implementation underfunded. Thus the effects of thousands of chemicals remain unknown in the United States as well and few toxic substances have been banned outright under TSCA in the recent past.

Scientists suggest that a significant portion of the un-assessed substances may be persistent, bioaccumulative and toxic, and recommend a system to set priorities for responsive strategies based on factors such as degree of bioaccumulation and biomagnifications, persistence based on biodegradability and oxidation potential, long range transport, and quantity in use. Such a system would rank substances based on ability to contaminate open water such as the Great Lakes and the food web. Developing a comprehensive data base and sharing information between like jurisdictions, e.g., among states and provinces, would increase efficiency and accelerate the assessment process.

Recommendations

Stronger Action on Toxics

Updating and strengthening the framework for assessment and action on toxic substances

2.a. The Parties must update the framework and systems through which the governments identify and set priorities for taking action on substances of concern (including breakdown products or substances of similar structures and modes of action) currently in use, generated, released, transferred or disposed of in the Great Lakes Basin.

i. The first step would be to categorize the substances based on their hazardous properties including whether they are persistent, bioaccumulative, carcinogenic, mutagenic, endocrine disrupting, a respiratory toxic, a neurotoxic, or have potential reproductive or developmental impacts.

ii. A second set of factors is the behavior of substances in the environment, incorporating criteria such as: degree of bioaccumulation and biomagnification; persistence based on biodegradability oxidation potential;[6] long range transport; and quantity in use. Such a system would rank substances based on ability to contaminate open water, such as the Great Lakes, and the food web.[7]

iii. Additional considerations, such as potential for exposure to sensitive and/or at-risk populations (i.e., children, women, Aboriginal people/tribes, workers, new immigrants, etc.) should also be included.

iv. Precedents for this work are in place, such as the European Union's Registration, Evaluation & Authorization (REACH) program, the U.S. EPA Toxic Substance Control Act (TSCA) Inventory, and Canada's Categorization of the Domestic Substances List required under CEPA 1999. All provide categorization (screening) models. Other useful filters are the lists maintained by the International Agency for Research on Cancer, and California's Proposition 65. Once a substance is identified as having hazardous properties it should automatically be listed under the relevant Agreement Annex.

v. Efforts to categorize these substances should include an effective public engagement component. The results of testing for these criteria should be made public.

vi. To operationalize the precautionary principle, substances that have not been adequately tested or do not have sufficient toxicity information should also be prioritized by governments for additional testing.

2.b. Pending development of the assessment and ranking process, the Parties to the Agreement should adopt the assessments of another comparable jurisdiction, such as another Organization for Economic Co-operation and Development (OECD) country, if such an assessment has

been completed. Upon adopting that assessment, the Parties should adopt programs and measures to prevent contamination by or environmental damage from the priority chemical/substances, including banning of all manufacturing and use, where appropriate. Where this paragraph applies to a substance, the Parties should commit to assessing the substance within one year, a management plan in respect of the substance should be in place within one additional year, and the plan should be implemented within two further years. More stringent timelines would apply the greater the hazard posed by the substance. (See "Targets and Timelines for Acting on Toxic Substances," below.) The onus should be on the proponent to provide the Parties with toxicity data within a specified timeframe.

Improving Loadings and Sources Data

2.c. The governments should assist in the development of a database including details and trends on the use, generation, release, disposal and transfer of toxic substances in the Great Lakes. These data should be made publicly available in a user-friendly format. The database should be developed and administered under the auspices of the IJC. The data would be supplied by government agencies based on a specific protocol describing what information has to be submitted to the IJC, with timelines attached.

Proactive Measures for New Data and New Chemicals

2.d. The Parties should establish a process for consideration and evaluation of new data (including biomonitoring data) on both existing and new chemicals. Governments should immediately form a scientific working group under the auspices of the IJC to report on new chemical threats (such as pharmaceutical products, various flame retardants and the implications of nanotechnology) to the Great Lakes.

Targets and Timelines for Acting on Toxic Substances

2.e. The scientific working group recommended above should report to the Parties on the effectiveness of measures taken to address such threats including bans, enforceable timelines for phase out of toxic substances, as well as the success of other strategies such as product return and substitution.

2.f. Timelines should include the following:

- Substances identified as persistent, bioaccumulative and inherently toxic (PBiT) should be considered priorities for action and the Parties should collaborate to ensure that regulatory measures designed to eliminate the substances are in place within one year of such identification;
- For persistent and inherently toxic (PiT) or bioaccumulative and inherently toxic (BiT) substances, (1) a management plan should be in place within two years; and (2) the management plan should be implemented within one additional year.

Toxics Use Reduction Institute

2.g. A binational Great Lakes toxics use reduction institute should be set up under the auspices of the IJC, funded jointly by the governments, to provide technical assistance to businesses to meet elimination and reduction goals, with assistance in green chemistry and clean production.

Toxic Chemicals: Controlling Specific Sources

Cross-cutting strategies that deal with the broad scope of toxic pollution issues (as noted above) will establish a platform for progress on a wide range of toxic inputs to the lakes. However, there are equally significant steps that must be taken to control and prevent toxic pollution strategies through specific sources. These include sewage systems, sludge disposal, industrial "point" discharges, atmospheric sources, contaminated sediments and polluted runoff.

3. Sewage as a Source of Toxic Chemicals

Hundreds of toxic chemicals are commonly found in municipal sewage effluent and this is dangerous on three levels. First, municipal treatment plants are not designed to capture and render these chemicals harmless. Secondly, and more disturbingly, many of these toxic chemicals do not break down and tend to persist in the environment for a long time. Third, by volume, sewage continues to be among the top pollution sources to Great Lakes waters.

Even treated effluent can carry considerable pollution loads. For example, in 2003 the City of Toronto found the following chemicals in its final effluent: twelve metals, six volatile organics, two extractable organics, endocrine disrupting nonylphenols and nonylphenol ethoxylates, traces of dioxins and furans, and a banned pesticide.[8] Other pollutants that plants typically

release into Great Lakes waters include nitrate, ammonia and, in lesser quantities mercury, copper, zinc, manganese and cadmium. When released into water bodies, mercury can be converted to a far more toxic form called methyl mercury, which bioaccumulates in fish that may ultimately be consumed by humans. Metals such as copper and cadmium can be toxic to aquatic life at low concentrations.

Exact levels and types of pollution are difficult to quantify, because programs such as Canada's National Pollution Release Inventory (NPRI) only require pollutant releases to be reported if the total quantity released exceeds a set threshold. Thresholds can range from 10 tonnes to 5 kilograms (kg) depending on the pollutant, so significant levels can still reach the lakes without being reported. PollutionWatch.org reports that in 2001, almost 14 million kg of NPRI chemicals were "transferred to sewer systems in Canada."[9]

Harmful chemicals are introduced into the sewer system each time individuals or businesses let them into drains. Many household products including cosmetics, cleaning supplies and garden chemicals, contain substances that are toxic to fish and wildlife and can harm the environment. This problem is especially serious in municipalities that do not treat their sewage.

Recent studies have documented mounting evidence of the hazards of under-regulated or unregulated persistent bioaccumulative chemicals in the sewage stream. For example, fluorinated surfactant compounds (e.g. perfluorooctanoic acid and perfluorooctane sulfonate) have been detected in Lakes Ontario and Erie in increasing concentrations.[10] Perfluorooctane sulfonate (PFOS) is entering wastewater treatment plants (WWTP) in high concentrations.[11] Lakes Michigan, Huron, Ontario and Erie sediment core samples found that the flux of polybrominated diphenyl ethers (PBDEs) has increased dramatically over the last several decades.[12] Similar increases in PBDEs are noted in Herring Gull eggs of birds nesting in the Great Lakes.[13]

Recommendations

Persistent toxic contaminants in waste water

3.a. The Parties should harmonize their assessment and prioritization processes to better understand and reduce persistent contaminants of concern from WWTPs, as specified in recommendation 2.a.

3.b. Strategies should be developed to address persistent toxic substances entering the Great Lakes ecosystem in

sewage effluent, through combined sewer overflows or via land application of biosolids (e.g. sewages sludges or manure). Examples of promising strategies include source control through comprehensive sewer use by-laws,[14] and U.S. "pre-treatment programs" through which industrial effluent is first treated on site before being released into sewers. Programs directed at reducing household chemical use and improving household hazardous waste collection can also reduce toxic chemicals in sewage effluents and biosolids.

3.c. The governments should adopt and apply consistently the precautionary approach (as applied in the U.S. Toxic Substances Control Act and the revised Canadian Pest Control Products Act) to require manufacturers to assure the safety of new chemicals (including cumulative and synergistic effects) prior to manufacture and use. These programs should also be fully funded to regain their effectiveness.

3.d. For existing chemicals that remain in the ecosystem after their discharge, such as PCBs, new technologies must be developed to assure their complete destruction so they are not simply moved from one medium to another (e.g., landfilling or incinerating) or do not produce other toxic substances (i.e., heavy metals, dioxins and furans, etc.). The U.S. Great Lakes Legacy Act takes this approach by giving preference to funding for contaminated sediment cleanup projects that destroy contamination instead of just moving it.

4. Sewage Treatment Plants as a Source of Pharmaceutical Pollution and Endocrine Disruptors

Recent studies document the presence of a wide variety of substances contained in pharmaceuticals and personal care products (PPCPs) in the environment.[15] Municipal sewage, agricultural and aquaculture wastes have been identified as sources of PPCPs including: antibiotics, blood lipid regulators, analgesics, anti-inflammatories, antiepileptics, natural and synthetic hormones, methyl siloxanes and cyclic methyl siloxanes found in antiperspirants and deodorants and other PPCP, fragrances (musks), nonylphenol and nonylphenol ethoxylates (NPs and NPEs) found in surfactants used in detergents, disinfectants and antiparasiticides. Mounting evidence exists that some of these chemicals have the potential to induce adverse health effects in non-target species and possibly humans when exposed to low levels, especially in sensitive life stages and pop-

ulations. Effects of concern include disruption of development and reproduction in exposed individuals and their offspring, and enhancement of antibiotic resistant bacteria.

Many of the PPCPs are not persistent (e.g. NPs and NPEs, hormones, antiparasitics, estrogens, some pesticides and plasticizers). While generally not acutely toxic or bioaccumulative, non-persistent contaminants can be of concern because they may have biological impacts at very low doses. Generally, sources are industrial effluent, municipal sewage and land applied biosolids —sludges and manures from municipal sewage treatment and agriculture. Some of the risks of these non-persistent chemicals are contamination of drinking water sources, antibiotic resistant microorganisms in the environment, and endocrine disruption in fish and other biota leading to decreased reproduction.[16]

Recommendations

Pharmaceutical and endocrine disrupter contaminants in waste water

4.a. We recommend new language in the articles of the Agreement or the addition of a new annex that will result in the reduction of pharmaceutical and endocrine disrupter contaminants in the Great Lakes particularly from sewage treatment facilities. The strategies needed to manage non-persistent contaminants include:

- Developing programs to return unused substances to manufacturers.
- Improving treatment of domestic sewage to remove these substances and manage biosolids and sewage sludges.
- Regulating select contaminants known to be wastewater contaminants (beginning with those that are persistent, bioaccumulative and toxic). For example, regulations can target for removal and replacement select chemicals such as NPs and NPEs by industry and consumers as close to the source of generation as possible.
- Require labeling for products that are known to contain substances such as PBDEs, phthalates, and other significant Great Lakes contaminants listed under the Agreement Annex noted above.

5. Land Application of Sewage Sludge as a Source of Contaminants

Land application of municipal sewage sludge is a common practice and raises many concerns about residual chemicals in the sludge that can enter adjacent water bodies via runoff and groundwater discharge.[17] Furthermore, sewage sludge that has not been fully treated can contain pathogens that present a human health risk. Thus, sewage sludge must be managed in a manner that ensures that the pollutants in the sludge do not enter the environment, and in particular, the Great Lakes Basin.

If sewage treatment plants anaerobically digest their sewage sludge, the reduction in the overall volume of sludge is so great that the remaining residue can be managed through permanent destruction technologies or landfilling.[18] In addition, the anaerobic digestion of sewage sludge can produce a net energy gain in the form of methane gas, which can be captured and used as a fuel source. Most sewage treatment plants do not fully digest their sewage sludge and are thus left with a large volume of sludge that needs disposal making low cost but harmful practices, such as land application, more attractive.

Recommendations

Land application of sewage sludge

5.a. Require Waste Water Treatment Plants to implement complete anaerobic digestion of sewage sludge (or use a comparable sludge treatment technology), and encourage methane gas capture and use as a fuel source.

5.b. Require the remaining residues (after complete digestion) to be disposed through permanent destruction or in a secure manner (such as landfilling with pump and treat assurances).

5.c. If complete digestion of sludge takes place, sludge should be safer to apply to land. As such, land application of digested sludge should only be approved if the jurisdiction from which the sludge originates has source control (e.g. a comprehensive and enforced sewer use law) and industrial effluent pretreatment requirements to ensure that toxics loadings and pathogens are controlled.

6. Industrial "Point" Discharges as Sources of Toxic Pollution

According to Environment Canada, more than 360 chemical compounds have been identified in the Great Lakes. Many of

these substances are persistent toxic substances with impacts to the environment, wildlife and human health. The vast majority of these compounds are from industrial sources.

Reports generated by the 2002 U.S. Toxic Release Inventory (TRI) and Canada's National Pollutant Release Inventory (NPRI) documented that TRI and NPRI facilities (which include manufacturers, mine sites, electrical utilities, many hazardous waste sites, and chemical distributors—not sewage treatment plants or hospitals) released and transferred more than 627 million kilograms of pollutants (627,243,035 kilograms or 1,382,819,995 pounds) into the Great Lakes Basin—and that was just one year. About 16%, or more than 101 million kilograms, of pollutants were released into the air while approximately 5,280,002 kilograms (over 11 million pounds) of pollutants were released to water from facilities in the Great Lakes Basin.[19]

Recommendations

Industrial Point Sources

6.a. The Agreement review needs to engage an independent party to assess the role that cutbacks in regulatory program staff and budgets within environmental agencies in the United States and Canada have had on meeting objectives to curtail toxic pollution from industrial sources.

6.b. The Agreement should establish benchmarks for the Parties to re-commit sufficient resources for enforcement of programs such as the U.S. Great Lakes Water Quality Initiative, and sufficiently staff discharge permit programs to eliminate backlogs and "rubber stamp" permit re-issues.

6.c. Require proponents using and releasing substances listed under the Agreement Annex to prepare toxic use reduction plans, including timelines for reduction and elimination of toxic substances.

6.d. Expand pollutant release and transfer registries to collect and disseminate pollution data from the Great Lakes Basin.

7. Airborne Sources of Toxic Pollution

The PollutionWatch 2006 report[20] on Great Lakes also highlighted that 2002 releases from Great Lakes facilities reporting to TRI and NPRI recorded more than 101 million kg of pollutants released to air. This represents 16% of all releases and transfers. More than 98 million kg of these air releases are con-

sidered respiratory toxicants.[21] The releases and transfer data from the PollutionWatch report provides one glimpse of the extent of toxic air pollution in the Great Lakes. Many facilities are not required to report releases and transfers of thousands of substances in the market. Despite this gap, the full impact of air deposition in the Great Lakes remains unclear because the region is also affected by many sources outside the Basin.

Great Lakes Critical Pollutants, including mercury

IJC research first established the atmosphere as the major source of new toxic pollution in Lakes Michigan, Huron and Superior more than twenty years ago. Airborne sources of toxic pollution are still a major and poorly controlled source today. The Agreement's 1987 Protocol established Annex 15 to monitor and report on airborne sources of toxic pollutants, including the "critical pollutants"[22] as defined in Annex 2. The Parties were obligated under Annex 15 to "develop, adopt and implement measures for the control of the sources of emissions of toxic substances and the elimination of the sources of emissions of persistent toxic substances in cases where atmospheric deposition…significantly contributes to pollution of the Great Lakes System." Many of the critical pollutants are still polluting the lakes via the atmosphere today. While some are now banned from manufacture and use in the United States and Canada, even banned chemicals such as PCBs and DDT continue to be a threat.

For example, the recirculation of volatile PCBs and other compounds from contaminated sediments is also a significant source of atmospheric pollution that becomes new deposition to other areas in the lakes. DDT used elsewhere in the world still rains into the Great Lakes. PCBs and DDT are good examples of why we need comprehensive strategies to manage toxics: a major part of the solution to atmospheric inputs is to clean up and destroy contaminated sediments. DDT can only be managed through international cooperation.

Some of the airborne critical pollutants are still in active use. Mercury is perhaps the most notable example. It is a natural by-product of coal combustion, widely used in lighting products and many industrial processes, and a dominant foodweb contaminant throughout the Great Lakes region and marine ecosystems. Federal regulation of mercury emissions is grossly inadequate in the United States and Canada.

Flame Retardants

New chemicals are raising new concerns about airborne distribution of toxic chemicals in the Great Lakes. A new generation of brominated flame retardants has been detected in the Great Lakes in measurable levels. The past and present use of PBDEs has contributed to the gradual increase of PBDE levels in North America. Unlike Europe, where there has been a decline in PBDE levels due to a ban on PBDEs, neither the US nor Canada have implemented substantive bans on these chemicals. Monitoring data demonstrate that a significant route of exposure for PBDEs is air.

Flame retardants in the PBDE family are widely used in clothing, upholstery, carpeting and many other products. They are released to the environment during manufacturing and processing operations, throughout the service life of articles containing PBDES and when articles containing PBDEs are disposed of.[23] Regulatory action banning and phasing out these substances, including changes in manufacturing, may be the only solution for controlling their distribution in the Great Lakes and other aquatic food webs.

Recently, Canada proposed to add seven PBDEs including pentabromodiphenyl ether, octabromodiphenyl ether and decabromodiphenyl ether on the Toxic Substances List (Schedule 1) of the Canadian Environmental Protection Act, but only tetraBDE, pentaBDE and hexaBDE would be proposed for virtual elimination.

Recommendations

Airborne Sources of Toxic Chemicals

7.a. The IJC should conduct an assessment of the role that the Stockholm Convention on Persistent Organic Pollutants ("POPs" treaty) is playing in reducing (or failing to reduce) deposition of airborne toxic chemicals in the Great Lakes and make recommendations for further action based on those findings to the Parties.

7.b. The Parties should re-commit resources to comply with Annex 15 of the 1987 Agreement, especially with regard to establishing controls and reduction strategies for sources of mercury.

7.c. The Agreement should recommend that the Parties ban the manufacture and use of PBDE fire retardants.

8. Contaminated Sediments: Cleaning Up the Languishing Toxic Legacy

In addition to the continued onslaught of new pollution, the

Great Lakes are troubled by a substantial burden of accumulated pollution. The toxic legacy is a primary source of degraded water quality, one of the major long-term threats to human health and a primary cause of lost or impaired "beneficial uses"—a formal list of 14 factors that includes uses such as fishing, safe consumption of fish, swimming, fish and wildlife habitat, etc.[24]

Failure to Remove the *Concern* from "Areas of Concern"

In response to findings prompted by the Agreement, the federal governments have designated 43 Areas of Concern (AOCs). The primary "concern" for these areas (except for Severn Sound) is the high concentration of toxic pollutants accumulated in the bottom sediments of Great Lakes harbors and rivers. In 1987, under Annex 2 of the amended Agreement, the federal governments committed to clean up these AOCs through the Remedial Action Planning (RAP) process.

Following 1987, however, neither U.S. EPA nor Environment Canada provided adequate support for this program. Since 1987 only three AOCs have been "delisted," i.e., officially cleaned up, (Collingwood and Severn Sound, in Canada, and Oswego in the United States). Another two (Spanish Harbour in Ontario and Presque Isle Bay in Pennsylvania) have been designated as "areas in recovery" because prescribed actions have been completed but beneficial uses have not all been restored as of yet. Actions are underway in the other sites, but progress and the level of activity varies considerably. It is difficult to estimate when we can anticipate cleanups to be complete, or when beneficial uses might return to the remaining 39 areas of concern, but it appears to be decades away. Clearly a different strategy and responsive timeline are called for.

Environment Canada and the U.S. EPA estimate that between 1997 and the end of 2004, 3.7 million cubic yards of sediments were removed and treated from AOCs on the U.S. side and 0.045 million cubic yards in AOCs on the Canadian side. The U.S. Policy Committee estimates that 75 million cubic yards of contaminated sediments requiring action remain on the U.S. side. The estimate for Canadian sediments requiring remediation is 44.7 million cubic yards (34.2 million cubic metres).

In 2000, the IJC concluded that progress on contaminated sediments cleanup was "proceeding far too slowly due to inadequate funding."[25] Since then, Great Lakes NGOs pressed the U.S. Congress to pass the Great Lakes Legacy Act, which authorized $270 million in federal funding over five years. The Legacy Act, which passed

with bi-partisan, industrial, and NGO support, is providing about $20 million in U.S. federal funding today to clean up contaminated sediment sites. This marks a major victory as the problem had been identified and a down payment made for more restoration funding.

Funding is the key to sediment cleanup. Appropriations under the Legacy Act have been consistently lower than the authorized amounts. Moreover, to move forward with cleanup, a site must have a cleanup plan such as a RAP in place and the availability of federal funds depends on state and local matching funds. Financially strapped Great Lakes states and local governments have struggled to meet the required matches, and have often not succeeded. However, the federal government commitments still need to be much more substantial. The U.S. Policy Committee has estimated that contaminated sediment cleanup costs in the U.S. AOLs alone "could range from $1.5 billion to $4.5 billion."[26] This would require dramatic increases in funding. The Great Lakes Regional Collaboration concluded that the Legacy Act authorization and appropriations should be increased from $50 million a year to $150 million a year.[27] The funding dedicated to contaminated sediments cleanup on the Canadian side has been even less adequate and inconsistent.

Treatment Strategies

When contaminated sediments are removed, the methods used to destroy or dispose of them tend to be incineration, confined disposal facilities (CDF) in the Lakes, or upland landfills. This usually simply means the transfer of the risks from the sediments to another location. The governments must focus on contaminated sediment treatment methods that result in the permanent destruction of the toxic substances and do not result in the transfer of the contaminants to another location or medium.

For areas where contaminants have been removed there may be a substantial period of time between when remedial actions are finished and the beneficial uses are restored. Governments have been proposing that an "area in recovery" stage be added to Annex 2 to address this situation. Public interest groups are concerned that this opens the door to accepting impaired beneficial uses for extended periods and may encourage the practice of relying only on natural processes such as sedimentation to return beneficial uses to an area. There is a tendency to focus on "no intervention" strategies or separation methods for addressing contaminated sediments rather than removal and destruction. NGOs are concerned that this may not result in adequate cleanups or may result in delays.

Challenges with public involvement

The potential of the public role has not been realized in the RAP process. For example, Section 2(e) of Annex 2 requires "public involvement" in the RAP and Lakewide Management Plan processes. The governments have failed to provide sufficient and consistent resources for public involvement in the process. Also governments have not recognized the importance of including public involvement after plans have been developed, even though the Agreement requires public involvement in "all actions" under Annex 2.

Problems in reporting to and receiving comments on RAPs from the IJC

The governments have expressed substantial concern with the reporting process outlined in Annex 2 and have in some ways ignored these provisions in the Annex. Concern has also been expressed that the IJC has taken too long to comment on RAP reports submitted to them. As a result, the role of the IJC as an outside commentator on individual RAPs has been substantially reduced recently.

Recommendations

Cleaning up Contaminated Sediments

Remedial Action Plans

The current Agreement addresses RAPs through Annex 2. Contaminated sediments have their own annex (Annex 14) and are also part of Annex 2, although not specifically named there because all RAPs but one need cleanup of contaminated sediments. Annex 2 details the problems that must be addressed through RAPs and the steps in the planning and delisting process.

8.a. We strongly urge the formation of a Basin-wide citizens' committee under the auspices of the IJC to be a watchdog on the implementation of these two parts of the Agreement. In addition, the Binational Toxics Strategy should take a more active role in the contaminated sediments program since this is listed as one of the issues in the BTS agreement.

8.b. We recommend integrating the two distinct sections in the Agreement (Annex 14 and within Annex 2) that address contaminated sediments into one cohesive set of objectives in future Agreement text.

8.c. We do not recommend expanding the scope of RAPs. We believe that the RAP scope should remain focused on contamination problems. Our focus should be on doing better—not doing more. The broader range of issues in an area

should appear under the watershed management planning components in Annex 13 of the Agreement (see similar recommendations 9.a. under stormwater management and 10.d. under agricultural pollution). Instead of expanding the RAP program, the watershed management plans section in Annex 13 should be developed to require the development of watershed management plans for all parts of the Great Lakes and St. Lawrence River Basin. The RAP process in Annex 2 should remain focused on addressing areas with higher than average contamination problems.

8.d. The wording of some of the impairments listed in Annex 2, Sec 1(c) should be clarified or expanded. For example, "beach closings" could be expanded to refer to all recreational uses—not just those at beaches.

8.e. We recommend that, if the Governments propose an "an area of recovery" stage to be recognized in Annex 2 (for areas where remedial actions have been taken and beneficial uses are not yet restored), the Annex clearly specify that certain conditions must be met for this classification to be accepted. These should include showing that all necessary pollution sources have been shut off and that all necessary clean-up actions have been taken. It also should require an on-going funded monitoring system, periodic reporting on recovery progress, and a mechanism for undertaking additional actions, if monitoring indicates the need for such or if clean-up criteria change. A proposal to enter a recovery phase should go to the IJC for comment prior to such a designation. The public should be included throughout the recovery time.

Role of IJC and Public Involvement

The IJC needs to take a much stronger role in reviewing RAPs and contaminated sediment matters and in being an advocate for the full implementation of the Agreement.

8.f. IJC independent reviews once played an important role in the RAP process. We recommend that the governments follow the provisions of Annex 2 and submit the RAP documents to the IJC for review and comment. The IJC should be required to provide their comments within a specified time-frame after receipt of the RAP documents. If the governments decide to continue doing updates of each RAP every two years, Annex 2 should be amended to require that these also be submitted to the IJC for review and comment.

8.g. Section 2(e) of Annex 2 should be strengthened to require to that there is a strong public role in decision-making, recognizing the bodies such as the public advisory committees as leaders and co-decision-makers. It also should include a commitment to fund serious public involvement.

Contaminated Sediment Removal Practices

8.h. The governments should make substantial long-term financial commitments to the cleanup of contaminated sediments in the range of $7–10 billion.

8.i. Wording should be added to Annex 14 to specify the criteria for addressing contaminated sediments. These should include criteria for the use of "no intervention" strategies as follows: "no-intervention" strategies should only be allowed under extremely rare circumstances, and only when:

- Contamination at the source has been cut off and there is periodic monitoring to confirm on a continuing basis that the source does not pose a problem;
- On-going monitoring ensures that beneficial uses are being restored; and
- The contamination is wide-spread and low-scale so as to not cause cumulative ecological harm.

8.j. Consistent with the U.S. Legacy Act approach, priority treatment strategies should be removal and destruction, not transfer of contaminants to confined disposal facilities, upland landfills or incineration.

8.k. Section 3 (b) of Annex 14 calls for "the use of contaminated sediment in the creation of land." This wording could allow, even sanction, the creation of new contaminated sites. The section should be changed to read: "beneficial reuse of *decontaminated* sediments."

Nutrients, Stormwater Runoff and Other Pollution

Gains made in controlling nutrient pollution (primarily phosphorus and nitrogen compounds) following the 1972 Agreement have been offset in recent years by increasing loads of pollution from treatment plants and agricultural and suburban runoff. Nutrient-related problems such as oxygen depletion have been exacerbated in some cases by the effect that zebra mussels are having on water chemistry and biology. Other conventional pollu-

tants, such as suspended solids (e.g. silt and fine debris) remain a concern as well, especially with regard to stormwater runoff from agricultural and urban areas. Stormwater is also a source of human and animal bacteria and pathogens, especially when sewage treatment plants overflow. Livestock operations also contribute nutrients and bacteria to Great Lakes water, and lawns and farms contribute pesticides, herbicides and fertilizers, adding to toxic loads as well.

9. Stormwater Runoff and Sewage Overflows: A Continuing Source of Nutrient and Pathogen Pollution

Many municipal treatment systems in the Great Lakes region were designed to combine the flow from both storm drains and waste sewers. As a result, storms frequently cause overflows at treatment plants, and untreated sewage (high in nutrients and bacteria) is released into the lakes and their tributaries. Much of the region's sewage treatment infrastructure was built in the years directly following the 1972 Agreement. These systems are aging and many are inadequate to meet current needs, including the increased volume of wastewater imposed by suburban growth. Treatment plants in Milwaukee, Muskegon, and Cleveland, for example, have released billions of gallons of untreated sewage into the Great Lakes in recent years. Funding for infrastructure improvements in the region has been limited in recent decades, with the exception of a few notable projects.

Although infrastructure improvements are needed in many areas, the challenge for the next generation of the Agreement is to encourage the Parties to address sewage overflows in a different manner than in previous Agreements. Much of the current Agreement language and today's infrastructure are designed to capture and control discharges, not *prevent* heavy doses of clean rainwater from entering and overwhelming systems. Municipal wastewater treatment plans (WWTPs) are expensive to build and maintain, and WWTPs can almost never be built large enough to handle all major storm events. As a result, watershed and stormwater management programs are an essential strategy for reducing sewer overflows.

Recommendations

Sewage Overflows

The Agreement must:

9.a. Identify target opportunities for "green infrastructure" projects such as green rooftops and permeable pavement to

reduce sewer overflows in key watersheds—especially those in which treatment plants with chronic and significant overflows are sited.

9.b. Call for more effective use of existing authorities, such as the U.S. EPA's "Nine Minimum Controls" and the restoration of funding, such as through the State Revolving Fund (SRF) to finance "green infrastructure." This preventative approach will almost always be less expensive and yield better ecological results than to maintain the current Agreement approach of attempting to treat sewage overflows at the "end of the pipe."

9.c. Set objectives and benchmarks for a new generation of sewage treatment upgrades and infrastructure consistent with "green infrastructure" efforts above.

10. Agricultural Runoff and Concentrated Wastes

Pollution from agriculture continues to trouble Great Lakes regional water quality. Significant portions of the Great Lakes Basin include intensively farmed lands in one of the most agriculturally productive regions in the world. Primary sources of agricultural pollution are runoff from croplands and animal waste. Rainwater and snowmelt carry loads of eroded surface soils, along with fertilizers and pesticides. Livestock operations —especially the new wave of confined animal "factory farms"— concentrate heavy loads of manure (and even dead animal remains) in their waste streams. The region's agricultural activities continue to degrade water quality through these factors:

- Fertilizers, such as nitrates, nitrites, and phosphorous
- Pesticides and herbicides
- Sedimentation that can choke fish spawning grounds and can otherwise provide material that persistent, bioaccumulative contaminants can bind to, to remain bioavailable in the environment
- Manure-based pollution, such as microbes, pathogens, and hydrogen sulfide. Likewise, hydrogen sulfide is the most toxic gas related with liquid manure storage. It is soluble in water and is produced by anaerobic decomposition of organic wastes. As such, hog manure is both an air and water pollutant with potentially serious health implications.[28]

- Antibiotics (and other veterinary medicines) used in livestock. Antibiotics or their byproducts can be excreted from livestock and washed into area waterways. Their overuse can lead to the development of bacteria resistant to antibiotics. In turn, more antibiotics must be used, thereby creating a "vicious cycle" in their overuse.[29]

Recommendations

Controls for Agricultural Runoff and Livestock Waste

10.a. Specify better composting practices of agricultural wastes.[30]

10.b. Call for turning agricultural wastes into clean, renewable energy sources—a strategy that can address two critical concerns simultaneously.[31]

10.c. Require pre-treatment of manure to eliminate pathogens prior to spreading on fields.[32]

10.d. Identify priority Great Lakes tributaries for watershed management and runoff control programs in Great Lakes; set benchmarks for reducing pollution from conventional and industrial-scale agriculture. (See also recommendation 8 c.)

B. Mounting Ecological Stresses that Affect Water Quality

Traditional pollutant loadings are not the only factors that affect water quality. The capacity of the Great Lakes ecosystem to sequester or decontaminate pollutants, non-traditional such as the non-native life forms found in ships' ballast water releases, and master variables such as climate conditions that can alter the context and impact of pollutants, can also have dramatic effects on water quality.

The interfaces between land and water—coasts, stream and river banks, wetlands, and headwaters of Great Lakes tributaries—provide valuable habitats for the region's biota and important "ecosystem services" that affect water quality, including water filtration (including flood water storage and filtration), silt trapping, and oxygen enrichment. Without sufficient protection and restoration strategies, these valuable areas will continue to be degraded and destroyed, and the result will be adverse effects on water quality.

A second area of significant stress to the ecosystem is aquatic invasive species, which have fundamentally changed the Great Lakes food web, species distribution, habitat, and water chemistry.

Aquatic invasive species are biological water pollution and should be addressed by the Agreement as such.

Environmental changes associated with global warming are becoming increasingly evident in the Great Lakes region. Already observed and predicted climate change effects could include substantially greater precipitation, more concentrated precipitation, shifts in the seasonal distribution of precipitation, and reductions in water levels. Separately or together these effects could increase airborne toxic loadings, increase ambient concentrations of existing pollutant loadings, and expose contaminated sediments and mobilize their pollutant loadings, among other possible adverse consequences for water quality.

Each of these stressors merits thoughtful assessment regarding the manner in which they should be addressed in future Agreements or other binational mechanisms to safeguard the Great Lakes ecosystem.

11. Habitat Loss and Degradation

The characteristics that make places where land and water meet attractive to the fish, wildlife, and other Great Lakes biota are also what make them attractive to people. Traditional development trends favored transforming wetlands, river banks, and coasts into industrial complexes and today favor residential and recreational facilities.

Wetlands are natural pollution filtration and water retention systems that enhance water quality through reduced turbidity that allow silt to settle, increased filtration of groundwater, and reduced contaminant loadings. In addition to these physical characteristics, various microbial, entomological, floral and even mammalian biological functions fix and at times metabolize pollutants.

Despite laws and regulatory structures intended to inhibit and even reverse losses of water quality-enhancing habitat, the Lake's "kidneys" are in perpetual jeopardy of encroachment, re-engineering, and destruction. Although laws in both nations have slowed the pace of wetland destruction since the establishment of the first Agreement, significant net losses of wetlands are still the norm.

Habitat protection is insufficient, as it typically involves efforts to preserve individual species. Some forums that provide protection include:

- The Great Lakes Fishery Commission (primarily focused on sea lamprey control and productivity of fish stocks);

- The North American Waterfowl Management Plan (dedicated to the protection of certain habitat for specific migratory species, with significant investments in wetlands protection for open-water species);
- Lakewide Management Plans (LaMPs are a lake-by-lake approach initiated under the 1987 Agreement, led by a team from each nation's environmental agency, and designed to address habitat and species issues in addition to other concerns. These have operated to limited effect with limited funding and no force of law); and
- Various domestic programs, such as those administered by the U.S. Fish and Wildlife Service, and the Canadian Wildlife Service.

None of these forums apply regional management principles to the restoration of ecosystem processes across international borders. Because restoring the inherent water quality protection capacity of the Basin ecosystem cannot be achieved by purely localized activity (for example, restoration of a single coastal wetland complex), a binational forum is an appropriate setting for establishing Basin-wide efforts for protecting habitats that improve water quality.

Recommendations

Enhanced Water Quality through Habitat Protection

11.a. The Great Lakes Water Quality Agreement should contain a major goal of protecting and restoring habitat that enhances water quality.

11.b. The International Joint Commission or another independent binational institution should be charged and sufficiently funded to advise on the means for achieving this goal through:

1) Assessing the actual and potential water quality benefits of protecting and/or restoring specific shoreline and riparian areas;

2) Recommending to the Parties goals and objectives for protecting and restoring such places so that they can serve to protect water quality, with full awareness of the multi-jurisdictional cooperation such a plan must entail;

3) Evaluating the capacity of federal programs and existing authorities to execute goals and objectives, and;

4) Recommending to the Parties means of using or strengthening existing programs, and creating new ones as needed, to execute these goals and objectives, with a timeline for completion and specific objectives related to acreages per given year that are protected and restored.

11.c. The choice of wetlands to be restored should be based on their contribution to improving water quality. The Parties should commit to restoring 550,000 acres of wetlands in the U.S. portion of the Basin over the next 15 years, as recommended by the Great Lakes Regional Collaboration Strategy. Likewise, the IJC should recommend a target for acres of wetlands chosen on a similar water quality basis, to be restored on the Canadian side of the border. We recommend the restoration of a greater number of wetland acres should the IJC find such a target scientifically justifiable.[33]

12. The Onslaught of Aquatic Invasive Species

The Great Lakes now host at least 180 nonnative species, and a new species enters the lakes on the average of every 28 weeks. Aquatic invasive species (AIS) have radically altered the lakes' biological systems and water quality. The 2005 "tipping point" paper signed by more than 100 prominent Great Lakes scientists points out, "Invasive species are the most likely principal source of food web disruptions now occurring in the Great Lakes, and are implicated in the reproductive failures of some fish species," including as walleye, lake trout, yellow perch, and lake herring.[34]

Moreover, invasive species have been responsible for billions of dollars in water utility infrastructure maintenance and repair and millions of dollars annually in public investments in control programs.

In recent years, zebra and quagga mussels and the round goby have played a significant role in radically altering the ecological balance of the lakes. These species are efficient "filter feeders" that strip the waters of the plankton upon which native species depend. Lake Erie has been particularly affected, with impacts to walleye populations and outbreaks of botulism among the lake's fish and birds. Some have had serious impacts on Great Lakes water quality.

Inadequate controls

For more than a century, the Great Lakes have suffered an onslaught of aquatic biological invasions. Ranging from large

predacious fish like the sea lamprey to microscopic plankton like Bythotrephes, biological invaders have wreaked havoc on the Great Lakes ecosystem. Although sea lamprey control programs have achieved considerable success in containing (not eliminating) that predator's populations, strategies to successfully contain other species, such as zebra mussels, round goby and spiny water flea have not been effective.

In 2002, reports from the United States and Canada found, among other things, that:

- The federal governments of Canada and the United States have not responded effectively to the invasive species threat;
- Measures put into place to prevent aquatic introductions have not prevented new introductions;
- Canada and the United States have neither a binational approach to invasive species nor do they have a single agency in charge of managing the problem.[35]

We have no choice but to manage the aquatic invasive species already in the Great Lakes system, but failing to prevent new invasions is sheer folly. Biological pollution may be the most serious threat to the Great Lakes ecosystem today, and thus requires priority attention and a commitment by both nations.

The four major pathways of invasion are well known:

- AIS introductions from global waters carried in the ballast water of ocean-going ships that trade in international ports. These problematic ships include so-called "NOBOBs," ships traveling with "no ballast on board" that are thus virtually exempted from even the current weak regulations, despite remaining major AIS sources because they carry substantial quantities of residual water in their tanks and pipes;
- Transfers of AIS from port to port within the lake system in the ballast water of "lakers," ships that travel only around the Great Lakes;
- AIS migration into the Great Lakes from channels connected to other watersheds such as the Chicago Sanitary and Ship Canal; and
- The commercial trade in bait fish, fish-farm food fish, and in some areas, pet aquarium fish and plants.

New prevention and control programs must address each of these vectors.

Recommendations

Aquatic Invasive Species

Preventing AIS introductions via Ocean-going Vessels

Declare as a goal of the Agreement:

12.a. Complete prevention of the introduction of any additional non-native aquatic species to the Great Lakes via ocean-going vessel.

12.b. Binationally coordinated federal policies to meet the above goal no later than 2011.

12.c. Binationally coordinated federal policies applying only to the Great Lakes that include: 1) sufficiently strict ballast water discharge standards to achieve the above goal, or 2) closure to ocean-going vessels of the Great Lakes – St. Lawrence Seaway System. These would be set in the event that national standards fail to be set in a timely fashion or prove too lax for meeting the goals of the Great Lakes region.

Declare as an objective of the Agreement:

12.d. Substantial incorporation into national law the recommendations of a relevant study of trade and AIS currently in progress by the National Academy of Sciences and the Royal Society of Canada.[36]

Preventing AIS introductions via Inter-Basin Connections

Declare as a goal of the Agreement:

12.e. Complete prevention of AIS introductions via canals and other inter-Basin waterways that connect the Great Lakes Basin to a non-Great Lakes watershed.

Declare as objectives of the Agreement:

12.f. Establishment of binational responsibility for and oversight of aspects of inter-Basin connections that pertain to AIS introduction.

12.g. Permanent hydrological separation of the Great Lakes and Mississippi River Basins and other pertinent inter-Basin connections.

12.h. No construction of new inter-Basin connections and the closure of existing cross-Basin connections that have fallen into disrepair or disuse so that AIS transfers are no longer possible.

Preventing AIS introduction via trade in Live Organisms

Declare as a goal of the Agreement:

12.i. Complete prevention of AIS introduction through trade in and possible release of live non-native organisms.

Declare as an objective of the Agreement:

12.j. Establishment of a binational screening process related to live organisms in trade that classifies such organisms into three categories of injuriousness—prohibited, permitted, and conditionally permitted—with the burden of proof as to injuriousness placed on the prospective trader.

Preventing the Spread of Already-introduced AIS by Lakers

Declare as a goal of the Agreement:

12.k. Complete prevention of movement of already-introduced aquatic invasives species to new sites in the Great Lakes by "lakers"—ships that travel solely around the Great Lakes.

12.l. Binationally coordinated federal policies implemented no later than 2011 that assure that "lakers" do not transport AIS to Basin sites where they are not already established.

Integrating into the Agreement prevention of AIS introduction and spread

12.m. Include in Article 2 purpose and Article 3 objectives of the Agreement, the need for prevention of AIS introduction and spread.

12.n. Include the need for AIS research into Annex 17, integrating the recommendations from, among other sources, the Research Committee of the Great Lakes Aquatic Nuisance Species Panel.

12.o. Include in Annex 11 the need for AIS surveillance and monitoring.

13. Anticipating the Impacts of Global Warming

Climate change will likely be an increasingly important factor in Great Lakes water quality. Current research into potential climate change in the Great Lakes region predicts, among other effects, greater precipitation, possibly more intense precipitation events, yet lower water levels and flows due to an increase in temperature and evaporation.

Greater precipitation and more intense precipitation events will likely increase transport of contaminants into the lakes via increased runoff, increased contaminants in runoff, and increased incidents in which sewage treatment systems are forced to release untreated wastewater. These changes would likely increase total contaminant loads (due to increased event intensity) and further increase ambient concentrations (due to the lower levels and flows).

Lake levels are expected to drop due to increased evaporation. Recent news accounts on the Great Lakes Information Network report that scientists project that 1,100 square miles of new Lake Erie shoreline will emerge in the coming decades as Lake Erie shrinks. The shrinking surface area and receding lake levels pose a plethora of challenges, from refitting sewage treatment plants located on the shores of the lakes, to the exposure and potential dispersal of contaminated sediments in near-shore waters, to the isolation of coastal wetlands and vital habitat.

The region is a major source of greenhouse gasses, and strategies to reduce carbon dioxide emissions—a key greenhouse gas—from coal-burning power plants are linked to strategies to reduce mercury emissions from the same source. Given the potential ecological ramifications of global warming for the Great Lakes ecosystem and lake water quality, the Agreement, must at a minimum provide a mechanism to assess the likely impacts of global warming and develop recommendations for mitigating and preventing impacts of global warming on water quality.

To best protect and restore the functioning of the Great Lakes ecosystem, the Great Lakes community needs to carry out:

- Monitoring, research, and analysis—learning what climate change effects are occurring or might well occur;
- Adaptation or remediation—taking steps that have the best chance of preserving ecosystem functioning in the face of actual or prospective climate change effects;
- Mitigation or prevention—taking steps to prevent the advent of climate change effects.

Recommendations

Global Warming

The Agreement should serve as a forum for binational preparation and response to the impacts of global warming on the Great Lakes. The Great Lakes region, like every other

region of the world, should play its part in reducing and controlling the causes of climate change. Examples of possible steps the Agreement could take on climate change include the following, all of which may complement other policies that show as much or more promise for combating this threat.

Convene Expertise; Establish a Guidance Body

13.a. Create of a board of experts and "disinterested" partner-stakeholders with a standing reference to assess on a regular basis, perhaps every five years, the state of regional climate change knowledge, determine priorities for funding, recommend policies based on the latest states of knowledge, and design and carry out public education efforts.

Strengthen Great Lakes Global Warming Research

13.b. Identify priority research topics and priority data gathering and modeling systems that could underpin priority research.

13.c. Place greater emphasis on adaptation options than is currently the case.

13.d. Create a central place for scientists to apply for research support. This would be valuable even if there were no net increase in resources.

Information exchange

13.e. Create a central repository and distribution system for relevant new research.

13.f. Organize regular conferences on Great Lakes global warming trends, impacts and adaptation strategies to foster communication among climate change researchers.

13.g. Create institutional discussion forums for providing input to national and international efforts that are planning new or enhanced sensing networks, so that Great Lakes regional research needs are best met.

13.h. Provide meteorological or synthetic climate data sets for each of the existing weather stations in the Great Lakes Basin, such that the data sets have been adjusted by incorporating reasonable climate-change assumptions that have been standardized across the Basin. Such adjusted data sets should be:

- ♦ Available to planners, consultants, and others who routinely run air dispersion and other types of computer models for regulatory and policy purposes, and would provide these users with modeling predictions under reasonably foreseeable climate conditions.

- ♦ Made available in at least two versions, representing distinct levels of climate change within the range considered likely by experts. The data sets should be based on assumptions that are standardized binationally across the Basin, and should be updated every five years to reflect new information.

Parties should initiate, expand and enhance requirements for Great Lakes-based facility reporting on Greenhouse gas emissions.[37]

Communications and Education

13.i. Design and implement public education programs.

13.j. Enhance the region's global climate change profile by supporting regular participation by Great Lakes climate change scientists in world climate change forums such that global climate change research projects are designed to better serve Great Lakes regional research needs

C. Gaps in Great Lakes Science

Effective monitoring and foundational research are important to achieving a healthy Great Lakes ecosystem. Monitoring, when based on a suite of integrated indicators[38] and conducted in a comprehensive and coordinated fashion, provides data for assessing the state of the Great Lakes ecosystem, predicting future developments, and evaluating and adapting restoration and prevention efforts.

14. Gaps in Surveillance and Monitoring

Monitoring data are valuable for their contribution to overall scientific knowledge about the Great Lakes and an important tool for tracking progress on objectives.

Unfortunately, monitoring inventories compiled by the Great Lakes Commission and Binational Executive Committee reveal "copious spatial and temporal gaps" in data, and inconsistency in data availability and timeliness.[39] Obstacles to effective monitoring, according to the Great Lakes Regional Collaboration Strategy, are insufficient funding and a lack of coordination

between the 536-plus Great Lakes monitoring programs (that is, programs collect different data, use different collection procedures, and employ different information management approaches).

Article 6 and Annex 11 of the Agreement obligate the governments to develop and implement a "joint surveillance and monitoring program" adequate to: assess achievement of the Agreement's objectives; measure local and whole lake response to control measures; evaluate water quality trends; identify emerging threats; and assist in the development of RAPs and LaMPs. Monitoring obligations are detailed in specific annexes.

As the governments are obligated but failing to implement such a monitoring program, our recommendations focus on recognized impediments to success, including inadequate monitoring coordination, insufficient funding, and lacking accountability.

Recommendations

Monitoring

14.a. Revise monitoring program obligations to meet revised/renegotiated Agreement objectives (Annex 11). For example, monitoring responsibilities might be expanded to include invasive species pathways.

14.b. Improve monitoring coordination by clarifying federal vs. state/provincial monitoring obligations.

14.c. Identify and charge the governments with adequately funding a monitoring coordination and review body (Article 7 and/or 8 and Annex 11). This body could be the Binational Executive Committee or a subgroup reporting to the Water Quality Board. This body would be responsible for:

- Maintaining Great Lakes Commission and Binational Executive Committee monitoring inventories and advising the governments on monitoring gaps/needs;
- Establishing and making standard monitoring procedures available to all monitoring programs;
- Assessing how well the governments are meeting monitoring obligations;
- Charging the Parties with meeting their commitments to participate in the development of the Global Earth Observation System of Systems (GEOSS), which will integrate in-place, airborne and space-based observation initiatives across the globe. (As participants in GEOSS, the govern-

ments are to "share observations and products with the system as a whole…and take the necessary steps to ensure that the shared observations and products are accessible, comparable and understandable, by supporting common standards and adaptation to users needs.")[40]

14.d. Charge the governments with collecting sufficient data for addressing all specified indicators (Article 6 and Annex 11).

14.e. Charge the governments with making monitoring data and analyses readily available to the public—that is, widely available, easily accessible, reported in a timely fashion (Article 6 and Annex 11).

Funding for monitoring

14.f. Charge the governments with providing sufficient funding for monitoring programs (Article 6 and Annex 11).

14.g. Charge the governments with establishing a joint endowed monitoring fund for select number of monitoring purposes particularly sensitive to funding interruptions (e.g. fish contaminant monitoring). The fund would serve to minimize any short-term funding interruptions but is not intended to replace the governments' commitment to provide sufficient ongoing funding (Article 6 and Annex 11).

15. Challenges with Indicators

Central to the coordination problem is a lack of commitment by the governments to implement a Great Lakes indicator suite —that is, to commit to collecting data on a compilation of indicators sufficient to characterize the chemical, physical and biological integrity of the Great Lakes ecosystem, pressures impacting components of the system, and management actions to alleviate those pressures.

Indicators are only occasionally detailed in the Agreement. Since 1987, the governments have been charged in Annex 1 and 11 with developing a series of lake-specific ecosystem objectives and related indicators. But nearly two decades later, objectives and related indicators are only listed for Lake Superior. Additional physical, chemical and biological qualities to be monitored or considered for measurement are mentioned or implied in Annexes 1 to 3 and 10 to 16. Annex 1 and 3 list desired chemical and physical levels, but other qualities (especially those related to human, fish, wildlife and ecosystem health) are almost completely unspecified.

The identification of a Great Lakes indicator suite has been undertaken through a series of biennial conferences hosted by the U.S. EPA and Environmental Canada called the State of the Lakes Ecosystem Conferences (SOLEC). Since 1998, a suite of 80-plus indicators have been selected through the SOLEC process. However, few monitoring programs have been modified to support the selected indicators.

Efforts should focus, therefore, on implementing these indicators—that is, ensuring the governments collect sufficient data to address the suite. Therefore, our recommendations focus on establishing an authoritative link between (revised / renegotiated) objectives and specific indicators and facilitating indicator implementation.

Recommendations

Indicators

15.a. Specify a formal selection process that identifies the indicators necessary for assessing Agreement objectives (as noted above, the SOLEC process currently performs this function but is not acknowledged in the Agreement). Aspects of the process that should be identified in the Agreement include general quality of selection criteria, the involvement of experts on various geographic areas and issues, and the participation of stakeholders from non-governmental organizations and all levels of government (Articles 7 and 8 and Annex 11).

15.b. Specify and charge the governments with implementing indicators for each Agreement objective:

- Applying the above selection process, specify ecosystem objectives (Annex 1) and related ecosystem health indicators for each lake (Annex 11);
- Applying the above selection process, specify chemical and physical indicators that are well-established and widely valued throughout the Great Lakes policy and scientific communities (relevant annexes); and
- Give a credible institution such as the Science Advisory Board, or the Royal Society or National Academy of Sciences, the authority to specify additional indicators (through the application of said indicator selection process) *on an ongoing basis*—that is, outside of the Agreement review process (Articles 7 and 8 and Annex 11).

15.c. Charge the governments with collecting sufficient data for addressing all indicators specified in the Agreement and by designated institution (Article 6 and Annex 11).

15.d. Charge the governments with making sufficient information on Agreement objective indicators readily available to all monitoring programs (Annex 11).

16. Research

As stated previously, research provides the scientific basis for effective monitoring systems and meaningful indicators, and predictive models for resource management decisions. Articles 5, 7 & 8, and Annex 17 of the Agreement detail a research program that should provide the support the governments need to meet Agreement objectives. Article 5 states that the governments shall "use their best efforts" to ensure that research funding agencies orient research programs in response to priorities recommended by the Commission and listed in Annex 17. The Commission is tasked with providing research recommendations in Article 7, and the Science Advisory Board is charged with advising the Commission and the Water Quality Board on research matters in Article 8. Annex 17 lists twelve research priorities, almost all of which focus on the dynamics, effects and management of pollutants and/or varying lake levels.

Unfortunately, according to the Great Lakes Regional Collaboration Strategy, released in December 2005, Great Lakes research is poorly coordinated and underfunded. Essential, high quality research is being conducted, but there is no comprehensive strategy being implemented to ensure priority issues are sufficiently researched. This failure no doubt contributes to a prevalence of research that is too narrowly focused on specific locations, lakes and issues, hindering our understanding of the complex relationships between the chemical, physical and biological aspects of the ecosystem and human activity. Compounding these problems is a lack of funding (e.g. over the last 10 years U.S. federal funding for Great Lakes research has remained level, at best, despite significant increases in research obligations).[38] Therefore, our recommendations focus primarily on improving research coordination and increasing research funding.

Recommendations

Research

Research Priorities

16.a. Revise research priorities to meet revised/renegotiated

objectives. For example, research priorities may be expanded to include research related to prevention of species invasions and development of "rapid response" methods for eliminating new invasions before they become established (Annex 17).

16.b. Include the natural functioning of the Great Lakes ecosystem as a research priority. The Annex focuses on pollutants—the natural functioning of the ecosystem is implied, at best. Understanding of the natural processes of the ecosystem in their own right should be a priority research topic (Annex 17).

Research Coordination

16.c. Designate the Council of Great Lakes Research Managers (CGLRM) or the most appropriate institution as the chief Great Lakes research coordination and review body. If the CGLRM is selected, its relationship with the Science Advisory Board must be clarified (Articles 7 and 8).

16.d. Charge the selected institution with responsibilities currently undertaken by the CGLRM, including maintaining a Great Lakes research inventory and identifying/reporting research priorities/gaps to the governments (Articles 7 and 8).

16.e. Charge the institution with identifying additional research priorities on an ongoing basis between Agreement review processes (Articles 7 and 8 and Annex 17).

16.f. Charge the governments with making participation in research inventory program mandatory for all agencies receiving research funding (Article 5).

Research Funding

16.g. Charge the governments with providing funding sufficient to meet research priorities (Article 5). Charge the governments with adequately funding research coordination and review body (Article 8).

16.h. Charge the governments with establishing joint endowed research fund (Article 5, Annex 17) with top priority given to research that monitors the effectiveness of implementation, and second priority to research that explores emerging threats or trends.

D. Barriers to an Effective Public Role

The Agreement's role as a focal point for citizen discourse on the Great Lakes has faded some in recent years, in part because of the complexity of the institutional and jurisdictional regime, but more significantly because of a waning commitment by the Parties and the IJC. To reclaim the Agreement's effectiveness, they must support public transparency in the processes and institutions that fostered public involvement in the past. We recommend the following steps to reinvigorate both the constituency and the functions of the Agreement that strengthen accountability and public involvement.

17. Strengthen Democratic Processes to Promote Enforceability and Compliance

17.a. The Agreement should specify a public petition process by which any resident of either country can claim a failure to implement the Agreement. Such petitions would be required to meet screening criteria, as judged by the IJC, to ensure that they are not frivolous or duplicative of existing litigation, and that alternative domestic procedures applicable to the petition topic have been exhausted. If a petition is valid, the Agreement should require an investigation of the petition topic by the IJC, a public response from the relevant governments, recommendations for action by the IJC, and a commitment by the governments to be bound by such recommendations.

17.b. The Agreement should contain language committing the governments to enacting its goals and objectives into national law.

17.c. All phrases that grant governments generic flexibility in implementing the Agreement, such as "shall seek to" and "will make their best efforts to" should be removed from the Agreement and replaced with clear commitments by specific agencies and by specific times.

18. Citizen Participation

The success of the Great Lakes Water Quality Agreement has depended on strong citizen participation that stimulated the political will of the governments. All forms of public involvement have declined in recent years. We recommend the following measures to reverse that decline.

Recommendations

Citizen Participation in Advisory Boards

18.a. The agreement should specify that representatives of the Basin's environmental groups, at least one from each country, should be appointed to the advisory boards overseen by the IJC, currently the Water Quality Board, the Science Advisory Board and the Council of Great Lakes Research Managers. Such representatives should have parity in number with representatives of industry.

18.b. Nominations for environmental group representation on the boards should be solicited from a body of all environmental groups in the Basin reasonably characterized as being regional in nature.

18.c. The Agreement should also specify that each board should have representation from the region's tribes and First Nations.

Support for non-federal board members

18.d. As specified for other representatives in the IJC's Mission Statement and Guiding Principles, environmental group representatives would be expected to perform as advisors in their personal and professional capacities rather than in their organizational capacities. Any needed travel, lodging, and communication expenses incurred by environmental and Tribal / First Nations representatives should be reimbursed by the IJC.

Public participation in reporting

18.e. The IJC and the governments should assure ample opportunity for public participation in all reporting processes, particularly at the IJC biennial meetings. The Agreement should specify that IJC board priority reports and government biennial progress reports required by the Agreement be distributed at least one month before the IJC biennial meeting, and that commissioners, report authors, and government officials will all be present at the biennial meeting to accept comment and answer questions from the public.

VII. Conclusion

The Great Lakes Water Quality Agreement is renowned among worldwide international environmental legal experts as a model for how two or more countries can set goals together for the care of shared water bodies. As such, the Agreement has for decades provided a focal point for hope and advocacy by countless citizens who want to see the water resources of our region protected and restored. But the Agreement's proud history is not enough to guarantee an auspicious future. Just as the Great Lakes-St. Lawrence River ecosystem is beleaguered by water quality, invasive species, habitat, and other key threats, the Agreement itself is at risk from outdated goals and objectives, governments that dodge efforts to be held accountable for meeting even outdated goals and objectives, and a citizenry that is largely unaware of the moral power of this precedent-setting pact. With this report, leading voices from around the Basin are calling for the next generation of the Agreement to lead the way to revitalized health for the ecosystem and the people, fish, and wildlife that depend on it.

Lake Superior's North Shore, Lake Superior Minnesota

Minnesota Extension Service, Dave Hansen

Endnotes

1 The Great Lakes: a chemical hot spot, at *http://www.ec.gc.ca/water/en/nature/lakes/e_hotspt.htm* (November 9, 2006).

2 Lee Botts and Paul Muldoon, *Evolution of the Great Lakes Water Quality Agreement*, p. 230 Michigan State University Press 2005.

3 Based in part on David Kriebel, Joel Tickner et al., "The Precautionary Principle in Environmental Science," *Environmental Health Perspectives*, Vol. 109, No. 9, September 2001, p. 871.

4 The partial intent of including "recovery" as a principle is to ensure a companion effort to the U.S. "Restoration" campaign. The term "restoration" is a misnomer, however, as the overall goal is to have a "restorative effect," not to "restore" the ecosystem to pre-settlement conditions.

5 Canada-United States Strategy for the Virtual Elimination of Persistent Toxic Substances in the Great Lakes (Binational Toxics Strategy).

6 Bioaccumulation, biomagnifications, and persistence can also be considered as hazardous properties under some ranking systems.

7 Muir. D., June 9, 2005. New Persistent Chemicals in Great Lakes Basin. Presentation at the IJC Biennial Meeting.

8 National Sewage Report Card, Sierra Legal Defence Fund, September 2004.

9 The precise figure for 2003 for transfers to sewage is 13,752,737.505 kg.

10 Boulanger B., and Hornbuckle. K.C., June 9, 2005. Fluorinated Surfactants in the Great Lakes: Today, Yesterday and Tomorrow. Presentation at IJC Biennial Meeting.

11 Ibid.

12 Song W., Li A., Ford J., Sturchio N.C., Rockne K.J.,Buckley D.R., and Mills W.J., 2005 Polybrominated Diphenyl Ethers in Sediments of the Great Lakes.2. Lakes Michigan and Huron. *Environmental Science & Technology.* 39:3473-3479 Song W., Ford J., Li A., Sturchio N.C., Rockne K.J., Buckley D.R., and Mills W.J., 2005. Polybrominated Diphenyl Ethers in Sediments of the Great Lakes. 3. Lakes Ontario and Erie. *Environmental Science& Technology.* 39: 5600-5605.

13 Norstrom R.J., Simon M., Moisey J., et al. 2002.Geographical distribution (2000) and temporal trends (1981-2000) of brominated diphenyl ethers in Great Lakes herring gull eggs. *Environmental Science & Technology* 36:4783-4789.

14 Sewer use by-laws are used in Ontario to prevent and control toxic substances from entering sewer systems. See *http://www.toronto.ca/water/protecting_quality/* and *www.toronto.ca/water/protecting_quality/sewer_bylaw/index.htm* for a description of the Toronto sewer use by-law (November 9, 2006).

15 Kolpin, D.W., Furlong E.T., Meyer M.T., Thurman M.E., Zaugg S.D., Barber L.B., and Buxton H.T. 2002. Pharmaceuticals, Hormones and Other Organic Wastewater Contaminants in U.S. Streams, 1999-2000: A National Reconnaissance. *Environmental Science and Technology*. Vol. 36. 1202-1211.

16 Metcalf C., June 9 2005. Non-persistent Contaminants in the Great Lakes Basin. Presented at the IJC Biennial Meeting.

17 Maureen Reilly. Commentaries. The case against land application of sewage sludge pathogens. Infectious Diseases & Medical Microbiology. July/August 2001. Vol. 12. No.4.

18 Often, incineration cannot be considered "permanent destruction" as it can create byproducts that can be harmful to the aquatic environment. Moreover, when properly processed, complete digestion of organic matter would result in little or nothing to incinerate, thereby eliminating incineration as an option.

19 PollutionWatch. 2006. Partners in Pollution: An Assessment of Continuing Canadian and United States Contribution to Great Lakes Pollution. *http://www.pollutionwatch.org/pub/Partners%20in%20Pollution_English_Lo.pdf*.

20 Id.

21 Ibid, p. 12.

22 As defined in the Great Lakes Water Quality Agreement Annex 2, 1.b., "Critical Pollutants" means substances that persist at levels that, singly or in synergistic or additive combination, are causing, or are likely to cause, impairment of beneficial uses despite past application of regulatory controls due to their:
(i) presence in open lake waters;
(ii) ability to cause or contribute to a failure to meet Agreement objectives through their recognized threat to human health and aquatic life; or
(iii) Ability to bioaccumulate.

23 Canada Gazette Part I, Vol, 140, No. 26 (July 1, 2006) – Order Adding Toxic Substances to Schedule 1 to the Canadian Environmental Protection Act, 1999.

24 Under Annex 2 of the Agreement, impaired beneficial uses "*means a change in the chemical, physical or biological integrity of the Great Lakes System sufficient to cause any of the following*:

- restrictions on fish and wildlife consumption
- tainting of fish and wildlife flavor
- degradation of fish wildlife populations
- fish tumors or other deformities
- bird or animal deformities or reproduction problems
- degradation of benthos
- restrictions on dredging activities
- eutrophication or undesirable algae
- restrictions on drinking water consumption, or taste and odor problems
- beach closings
- degradation of aesthetics
- added costs to agriculture or industry
- degradation of phytoplankton and zooplankton populations and
- loss of fish and wildlife habitat

Great Lakes Binational Toxics Strategy, *Draft 2005 Progress Report*, December 2005, table 6.1.

Great Lakes Regional Collaboration, *Great Lakes Regional Collaboration Strategy to Restore and Protect the Great Lakes*, December 2005, p. 36.International Joint Commission, *Tenth Biennial Report on Great Lakes Water Quality*, 2000, p 20.

25 International Joint Commission, *Tenth Biennial Report on Great Lakes Water Quality Agreement*, 2000, p. ii.

26 Great Lakes Regional Collaboration, *Great Lakes Regional Collaboration Strategy to Restore and Protect the Great Lakes*, December 2005, p. 36.

27 Ibid., p. 39.

28 High concentrations can be released by agitation and pumping of stored liquid wastes. In humans, this gas might cause asphyxia as well as eye and respiratory tract irritation. 0.1% concentrations cause immediate unconsciousness, and eventually death due to respiratory paralysis. Animals develop light fear, nervousness, and a loss of appetite when exposed to concentrations over 0.002%. Vomit, nausea, and diarrhea occur at 0.005% to 0.002% concentrations.

29 http://www.omafra.gov.on.ca/ (May 2, 2006)

30 One example of better composting practices is contained in *http://www.biontech.com/news/print-air/forbes.pdf* (November 9, 2006).

31 See, e.g., *http://www.canada.com/ottawa/news/city/story.html?id=b4479d89-13d6-44ac-b9b2-6946d1e97d18&k=79171&p=1* (November 9, 2006).

32 See, e.g., *www.cec.org/files/PDF/ECONOMY/Biomass-StageI_en.pdf*, pp. 27-31; *www.egr.msu.edu/age/aenewsletter/1_july_aug_04/bickert7_04.htm*; *www.manuremanagement.cornell.edu/* (November 9, 2006)

33 Great Lakes Regional Collaboration Strategy, p. 25. McDonald et al, 1998, and Fielder and Thomas, 2005, referenced in Bails, Beeton, Bulkely, DePhilip, Gannon, Murray, Regier, Scavia, *Prescription for Great Lakes Ecosystem Protection and Restoration (Avoiding the Tipping Point of Irreversible Changes)*, December 2005.

U.S. General Accounting Office, "Report to Executive Agency Officials: Invasive Species: Clearer Focus and Greater Commitment Needed to Effectively Manage the Problem," October 2002, *http://www.gao.gov/new.items/d031.pdf* and Report of the Commissioner of the Environment and Sustainable Development, chapter 4, *http://www.oag-bvg.gc.ca/domino/reports.nsf/html/c2002menu_e.html* (November 14, 2006).

The working title of this report is "Options to Eliminate Introduction of Non-indigenous Species into the Great Lakes."

34 Canada currently requires reporting from facilities on greenhouse gases under the National Greenhouse Gases Inventory. Reporting is required for specific sectors on six classes of GHGs.

35 An indicator is defined in the Information & Indicators Appendix of the GLRC Strategy as a "measurable feature that provides outcome-oriented, managerially and scientifically useful evidence of environmental and ecosystem quality or reliable evidence of trends in quality."

36 These criticisms are drawn from the GLRC Strategy, Information & Indicators Appendix, pp. 10-14.

37 The Global Earth Observation System of Systems (GEOSS): 10-Year Implementation Plan, *http://earthobservations.org/docs/10-Year%20Implementation%20Plan.pdf* (November 9, 2006).

38 These criticisms are drawn from the GLRC Strategy, Information & Indicators Appendix, p. 31.

RECOMMENDATIONS:

1. Overarching Goals and Strategies for Toxic Substances

1. a. The governments of Canada and the United States should re-commit their support for the goals of virtual elimination of persistent toxic substances and the Annex 12 goal of zero discharge.

1. b. The scope of these goals must be broadened to include substances other than persistent and bioaccumulative harmful pollutants including those that are carcinogenic, mutagenic, endocrine disrupting, or toxic to the neurological and reproductive systems.

1. c. Greater effort is required in addressing all sources of toxic pollution, with an emphasis on avoidance of the use of toxic substances through prevention, and substitution with safer alternatives.

2. Stronger Action on Toxics

Updating and strengthening the framework for assessment and action on toxic substances

2. a. The Parties must update the framework and systems through which the governments identify and set priorities for taking action on substances of concern (including breakdown products or substances of similar structures and modes of action) currently in use, generated, released, transferred or disposed of in the Great Lakes Basin.

2. b. Pending development of the assessment and ranking process, the Parties to the Agreement should adopt the assessments of another comparable jurisdiction, such as another Organization for Economic Co-operation and Development (OECD) country, if such an assessment has been completed. Upon adopting that assessment, the Parties should adopt programs and measures to prevent contamination by or environmental damage from the priority chemical/substances, including banning of all manufacturing and use, where appropriate. Where this paragraph applies to a substance, the Parties should commit to assessing the substance within one year, a management plan in respect of the substance should be in place within one additional year, and the plan should be implemented within two further years. More stringent timelines would apply the greater the hazard posed by the substance. See “Targets and Timelines for Acting on Toxic Substances,” below). The onus should be on the proponent to provide the Parties with toxicity data within a specified timeframe.

Improving loadings and sources data

2. c. The governments should assist in the development of a database including details and trends on the use, generation, release, disposal and transfer of toxic substances in the

Great Lakes. These data should be made publicly available in a user-friendly format. The database should be developed and administered under the auspices of the IJC. The data would be supplied by government agencies based on a specific protocol describing what information has to be submitted to the IJC, with timelines attached.

Proactive measures for new data and new chemicals

2. d. The Parties should establish a process for consideration and evaluation of new data (including biomonitoring data) on both existing and new chemicals. Governments should immediately form a scientific working group under the auspices of the IJC to report on new chemical threats (such as pharmaceutical products, various flame retardants and the implications of nanotechnology) to the Great Lakes.

Targets and timelines for acting on toxic substances

2. e. The scientific working group recommended above should report to the Parties on the effectiveness of measures taken to address such threats including bans, enforceable timelines for phase out of toxic substances, as well as the success of other strategies such as product return and substitution.

2. f. Timelines should include the following:

- Substances identified as persistent, bioaccumulative and inherently toxic (PBiT) should be considered priorities for action and the Parties should collaborate to ensure that regulatory measures designed to eliminate the substances are in place within one year of such identification;

- For persistent and inherently toxic (PiT) or bioaccumulative and inherently toxic (BiT) substances, (1) a management plan should be in place within two years; and (2) the management plan should be implemented within one additional year.

- A binational Great Lakes toxics use reduction institute should be set up under the auspices of the IJC, funded jointly by the governments, to provide technical assistance to businesses to meet elimination and reduction goals, with assistance in green chemistry and clean production.

3. Persistent Toxic Contaminants in Waste Water

3. a. The Parties should harmonize their assessment and prioritization processes to better understand and reduce persistent contaminants of concern from WWTPs, as specified in recommendation 2. a.

3. b. Strategies should be developed to address persistent toxic substances entering the Great Lakes ecosystem in sewage effluent, through combined sewer overflows or via land application of biosolids (e.g. sewages sludges or manure). Examples of promising

strategies include source control through comprehensive sewer use by-laws, and U.S. "pre-treatment programs" through which industrial effluent is first treated on site before being released into sewers. Programs directed at reducing household chemical use and improving household hazardous waste collection can also reduce toxic chemicals in sewage effluents and biosolids.

3. c. The governments should adopt and apply consistently the precautionary approach (as applied in the U.S. Toxic Substances Control Act and the revised Canadian Pest Control Products Act) to require manufacturers to assure the safety of new chemicals (including cumulative and synergistic effects) prior to manufacture and use. These programs should also be fully funded to regain their effectiveness.

3. d. For existing chemicals that remain in the ecosystem after their discharge, such as PCBs, new technologies must be developed to assure their complete destruction so they are not simply moved from one medium to another (e.g., landfilling) or do not produce other toxic substances (i.e., heavy metals, dioxins and furans, etc.). The U.S. Great Lakes Legacy Act takes this approach by giving preference to funding for contaminated sediment cleanup projects that destroy contamination instead of just moving it.

4. Pharmaceutical and Endocrine Disrupter Contaminants in Waste Water

4. a. We recommend new language in the articles of the Agreement or the addition of a new annex that will result in the reduction of pharmaceutical and endocrine disrupter contaminants in the Great Lakes particularly from sewage treatment facilities.

5. Land Application of Sewage Sludge

5. a. Require Waste Water Treatment Plants to implement complete anaerobic digestion of sewage sludge (or use a comparable sludge treatment technology) and encourage methane gas capture and use as a fuel source.

5. b. Require the remaining residues (after complete digestion) to be disposed through permanent destruction or in a secure manner (such as landfilling with pump and treat assurances).

5. c. If complete digestion of sludge takes place, sludge should be safer to apply to land. As such, land application of digested sludge should only be approved if the jurisdiction from which the sludge originates has source control (e.g. a comprehensive and enforced sewer use by-law) and industrial effluent pretreatment requirements to ensure that toxics loadings and pathogens are controlled.

6. Industrial Point Sources

6. a. The Agreement review needs to engage an independent party to assess the role that cutbacks in regulatory program staff and budgets within environmental agencies in the

United States and Canada have had on meeting objectives to curtail toxic pollution from industrial sources.

6. b. The Agreement should establish benchmarks for the Parties to re-commit sufficient resources for enforcement of programs such as the U.S. Great Lakes Initiative, and sufficiently staff discharge permit programs to eliminate backlogs and "rubber stamp" permit re-issues.

6. c. Require proponents using and releasing substances listed under the Agreement Annex to prepare toxic use reduction plans, including timelines for reduction and elimination of toxic substances.

6. d. Expand pollutant release and transfer registries to collect and disseminate pollution data fro the Great Lakes Basin.

7. Airborne Sources of Toxic Chemicals

7. a. The IJC should conduct an assessment of the role that the Stockholm Convention on Persistent Organic Pollutants ("POPs" treaty) is playing in reducing (or failing to reduce) deposition of airborne toxic chemicals in the Great Lakes and make recommendations for further action based on those findings to the Parties.

7. b. The Parties should re-commit resources to comply with Annex 15 of the 1987 Agreement, especially with regard to establishing controls and reduction strategies for sources of mercury.

7. c. The Agreement should recommend that the Parties ban the manufacture and use of PBDE fire retardants.

8. Cleaning up Contaminated Sediments

Remedial Action Plans

8. a. We strongly urge the formation of a Basin-wide citizens' committee under the auspices of the IJC to be a watchdog on the implementation of these two parts of the Agreement. In addition, the Binational Toxics Strategy should take a more active role in the contaminated sediments program since this is listed as one of the issues in the BTS agreement.

8. b. We recommend integrating the two distinct sections in the Agreement (Annex 14 and within Annex 2) that address contaminated sediments into one cohesive set of objectives in future Agreement text.

8. c. We do not recommend expanding the scope of RAPs. We believe that the RAP scope should remain focused on contamination problems. Our focus should be on doing better – not doing more. The broader range of issues in an area should appear under the

watershed management planning components in Annex 13 of the Agreement (see similar recommendations 9. a. under stormwater management and 10. d. under agricultural pollution). Instead of expanding the RAP program, the watershed management plans section in Annex 13 should be developed to require the development of watershed management plans for all parts of the Great Lakes and St. Lawrence River Basin. The RAP process in Annex 2 should remain focused on addressing areas with higher than average contamination problems.

8. d. The wording of some of the impairments listed in Annex 2, Sec 1(c) should be clarified or expanded. For example, "beach closings" could be expanded to refer to all recreational uses – not just those at beaches.

8. e. We recommend that, if the Governments propose an "an area of recovery" stage to be recognized in Annex 2 (for areas where remedial actions have been taken and beneficial uses are not yet restored), the Annex clearly specify that certain conditions must be met for this classification to be accepted. These should include showing that all necessary pollution sources have been shut off and that all necessary clean-up actions have been taken. It also should require an on-going funded monitoring system, periodic reporting on recovery progress, and a mechanism for undertaking additional actions, if monitoring indicates the need for such or if clean-up criteria change. A proposal to enter a recovery phase should go to the IJC for comment prior to such a designation. The public should be included throughout the recovery time.

Role of IJC and public involvement

8. f. IJC independent reviews once played an important role in the RAP process. We recommend that the governments follow the provisions of Annex 2 and submit the RAP documents to the IJC for review and comment. The IJC should be required to provide their comments within a specified timeframe after receipt of the RAP documents. If the governments decide to continue doing updates of each RAP every two years, Annex 2 should be amended to require that these also be submitted to the IJC for review and comment.

8. g. Section 2(e) of Annex 2 should be strengthened to require to that there is a strong public role in decision-making, recognizing the bodies such as the public advisory committees as leaders and co-decision-makers. It also should include a commitment to fund serious public involvement.

Contaminated sediment removal practices

8. h. The governments should make substantial long-term financial commitments to the cleanup of contaminated sediments in the range of $7-10 billion.

8. i. Wording should be added to Annex 14 to specify the criteria for addressing contaminated sediments.

8. j. Consistent with the U.S. Legacy Act approach, priority treatment strategies should be removal and destruction, not transfer of contaminants to confined disposal facilities, upland landfills or incineration.

8. k. Section 3 (b) of Annex 14 calls for "the use of contaminated sediment in the creation of land." This alarms us as it could just mean the creation of new contaminated sites. This section should be changed to read: "beneficial reuse of *decontaminated* sediments."

9. Sewage Overflows

9. a. The Agreement must identify target opportunities for "green infrastructure" projects such as green rooftops and permeable pavement to reduce sewer overflows in key watersheds—especially those in which treatment plants with chronic and significant overflows are sited.

9. b. There must be a call for more effective use of existing authorities, such as the U.S. EPA's "Nine Minimum Controls" and the restoration of funding, such as through the State Revolving Fund (SRF) to finance "green infrastructure." This preventative approach will almost always be less expensive and yield better ecological results than to maintain the current Agreement approach of attempting to treat sewage overflows at the "end of the pipe."

9. c. Objectives and benchmarks for a new generation of sewage treatment upgrades and infrastructure consistent with "green infrastructure" efforts above must be set.

10. Controls for Agricultural Runoff and Livestock Waste

10. a. Specify better composting practices of agricultural wastes.

10. b. Call for turning agricultural wastes into clean, renewable energy sources—a strategy that can address two critical concerns simultaneously.

10. c. Require pre-treatment of manure to eliminate pathogens prior to spreading on fields.

10. d. Identify priority Great Lakes tributaries for watershed management and runoff control programs in Great Lakes; set benchmarks for reducing pollution from conventional and industrial-scale agriculture. (See also recommendation 8 c.)

11. Enhanced Water Quality through Habitat Protection

11. a. The Great Lakes Water Quality Agreement should contain as a major goal of protecting and restoring habitat that enhances water quality.

11. b. The International Joint Commission or another independent binational institution should be charged and sufficiently funded to advise on the means for achieving this goal through:

- Assessing the actual and potential water quality benefits of protecting and/or restoring specific shoreline and riparian areas;

- Recommending to the Parties goals and objectives for protecting and restoring such places so that they can in fact serve to protect water quality, with full awareness of the multi-jurisdictional cooperation such a plan would necessarily entail;

- Evaluating the capacity of federal programs and existing authorities to execute this these goals and objectives, and;

- Recommending to the Parties means of using or strengthening existing programs, and creating new ones as needed, to execute these goals and objectives, with a timeline for completion and specific objectives related to acreages per given year that are protected and restored.

11. c. The choice of wetlands to be restored should be based on their contribution to improving water quality. The Parties should commit to restoring 550,000 acres of wetlands in the U.S. portion of the Basin over the next 15 years, as recommended by the Great Lakes Regional Collaboration Strategy. Likewise, the IJC should recommend a target for acres of wetlands chosen on a similar water quality basis, to be restored on the Canadian side of the border. We recommend the restoration of a greater number of wetland acres should the IJC find such a target scientifically justifiable.[1]

12. Aquatic Invasive Species

Preventing AIS introductions via ocean-going vessels

12. a. Complete prevention of the introduction of any additional non-native aquatic species to the Great Lakes via ocean-going vessel should be a goal of the Agreement.

12. b. Binationally coordinated federal policies to meet the above goal should be targeted for no later than 2011.

12. c. Binationally coordinated federal policies applying only to the Great Lakes that include: either sufficiently strict ballast water discharge standards to achieve the above goal, or closure of the Great Lakes – St. Lawrence Seaway System to ocean-going vessels. These would be set in the event that national standards fail to be set in a timely fashion or prove too lax for meeting the goals of the Great Lakes region.

12. d. An objective of the Agreement should be substantial incorporation into national laws of the recommendations of a relevant study of trade and AIS currently in progress by the National Academy of Sciences and the Royal Society of Canada.[2]

[1] Great Lakes Regional Collaboration Strategy, p. 25.
[2] The working title of this report is "Options to Eliminate Introduction of Non-indigenous Species into the Great Lakes."

Preventing AIS introductions via inter-basin connections

12. e. Complete prevention of AIS introductions via canals and other inter-Basin waterways that connect the Great Lakes Basin to a non-Great Lakes watershed should be a goal of the Agreement.

12. f. An objective of the Agreement should be the establishment of binational responsibility for and oversight of aspects of inter-Basin connections that pertain to AIS introduction.

12. g. An objective of the Agreement should be permanent hydrological separation of the Great Lakes and Mississippi River Basins and other pertinent inter-Basin connections.

12. h. An objective of the Agreement should be that no construction of new inter-Basin connections and the closure of existing cross-Basin connections that have fallen into disrepair or disuse so that AIS transfers are no longer possible.

Preventing AIS introduction via trade in live organisms

12. i. A goal of the Agreement should be complete prevention of AIS introduction through trade in and possible release of live non-native organisms.

12. j. An objective of the Agreement should be the establishment of a binational screening process related to live organisms in trade that classifies such organisms into three categories of injuriousness—prohibited, permitted, and conditionally permitted—with the burden of proof as to injuriousness placed on the prospective trader.

Preventing the spread of already-introduced AIS by lakers

12. k. A goal of the Agreement should be complete prevention of movement of already-introduced aquatic invasives species to new sites in the Great Lakes by "lakers"—ships that travel solely around the Great Lakes.

12. l. A goal of the Agreement should be binationally coordinated federal policies implemented no later than 2011 that assure that "lakers" do not transport AIS to Basin sites where they are not already established.

Integrating into the Agreement prevention of AIS introduction and spread

12. m. Include in Article 2 purpose and Article 3 objectives of the Agreement, the need for prevention of AIS introduction and spread.

12. n. Include the need for AIS research into Annex 17, integrating the recommendations from, among other sources, the Research Committee of the Great Lakes Aquatic Nuisance Species Panel.

12. o. Include in Annex 11 the need for AIS surveillance and monitoring.

13. Global Warming

Convene expertise and establish a guidance body

13. a. Create of a board of experts and "disinterested" partner-stakeholders with a standing reference to assess on a regular basis, perhaps every five years, the state of regional climate change knowledge, determine priorities for funding, recommend policies based on the latest states of knowledge, and design and carry out public education efforts.

Strengthen Great Lakes global warming research

13. b. Identify priority research topics and priority data gathering and modeling systems that could underpin priority research.

13. c. Place greater emphasis on adaptation options than is currently the case.

13. d. Create a central place for scientists to apply for research support. This would be valuable even if there were no net increase in resources.

Information exchange

13. e. Create a central repository and distribution system for relevant new research.

13. f. Organize regular conferences on Great Lakes global warming trends, impacts and adaptation strategies to foster communication among climate change researchers.

13. g. Create institutional discussion forums for providing input to national and international efforts that are planning new or enhanced sensing networks, so that Great Lakes regional research needs are best met.

13. h. Provide meteorological or synthetic climate data sets for each of the existing weather stations in the Great Lakes Basin, such that the data sets have been adjusted by incorporating reasonable climate-change assumptions that have been standardized across the Basin.

Communication and education

13. i. Design and implement public education programs.

13. j. Enhance the region's global climate change profile by supporting regular participation by Great Lakes climate change scientists in world climate change forums such that global climate change research projects are designed to better serve Great Lakes regional research needs.

14. Monitoring

14. a. Revise monitoring program obligations to meet revised / renegotiated Agreement objectives (Annex 11). For example, monitoring responsibilities might be expanded to include invasive species pathways.

14. b. Improve monitoring coordination by clarifying federal vs. state/provincial monitoring obligations

14. c. Identify and charge the governments with adequately funding a monitoring coordination and review body (Article 7 and/or 8 and Annex 11). This body could be the Binational Executive Committee or a subgroup reporting to the Water Quality Board.

14. d. Charge the governments with collecting sufficient data for addressing all specified indicators (Article 6 and Annex 11).

14. e. Charge the governments with making monitoring data and analyses readily available to the public – that is, widely available, easily accessible, reported in a timely fashion (Article 6 and Annex 11).

Funding for monitoring

14. f. Charge the governments with providing sufficient funding for monitoring programs (Article 6 and Annex 11).

14. g. Charge the governments with establishing a joint endowed monitoring fund for select number of monitoring purposes particularly sensitive to funding interruptions (e.g. fish contaminant monitoring). The fund would serve to minimize any short-term funding interruptions but is not intended to replace the governments' commitment to provide sufficient ongoing funding (Article 6 and Annex 11).

15. Indicators

15. a. Specify a formal selection process that identifies the indicators necessary for assessing Agreement objectives (as noted above, the SOLEC process currently performs this function but is not acknowledged in the Agreement). Aspects of the process that should be identified in the Agreement include general quality of selection criteria, the involvement of experts on various geographic areas and issues, and the participation of stakeholders from non-governmental organizations and all levels of government (Articles 7 and 8 and Annex 11).

15. b. Specify and charge the governments with implementing indicators for each Agreement objective:

- Applying said selection process, specify ecosystem objectives (Annex 1) and related ecosystem health indicators for each lake (Annex 11);

- Applying said selection process, specify chemical and physical indicators that are well-established and widely valued throughout the Great Lakes policy and scientific communities (relevant annexes);

- Recommend a credible institution such as the Science Advisory Board, or the Royal Society or National Academy of Sciences the authority to specify additional indicators (through the application of said indicator selection process) *on an ongoing basis* – that is, outside of the Agreement review process (Articles 7 and 8 and Annex 11).

15. c. Charge the governments with collecting sufficient data for addressing all indicators specified in the Agreement and by designated institution (Article 6 and Annex 11).

15. d. Charge the governments with making sufficient information on Agreement objective indicators readily available to all monitoring programs (Annex 11).

16. Research

Research priorities

16. a. Revise research priorities to meet revised / renegotiated objectives. For example, research priorities may be expanded to include research related to prevention of species invasions and development of "rapid response" methods for eliminating new invasions before they become established (Annex 17).

16. b. Include the natural functioning of the Great Lakes ecosystem as a research priority. The Annex focuses on pollutants – the natural functioning of the ecosystem is implied, at best. Understanding of the natural processes of the ecosystem in their own right should be a priority research topic (Annex 17).

Research coordination

16. c. Designate the Council of Great Lakes Research Managers (CGLRM) or the most appropriate institution as the chief Great Lakes research coordination and review body. If the CGLRM is selected, its relationship with the Science Advisory Board must be clarified (Articles 7 and 8).

16. d. Charge said institution with responsibilities currently undertaken by the CGLRM, including maintaining a Great Lakes research inventory and identifying/reporting research priorities/gaps to the governments (Articles 7 and 8).

16. e. Charge the institution with identifying additional research priorities on an ongoing basis between Agreement review processes (Articles 7 and 8 and Annex 17).

16. f. Charge the governments with making participation in research inventory program mandatory for all agencies receiving research funding (Article 5).

Research funding

16. g. Charge the governments with providing funding sufficient to meet research priorities (Article 5). Charge the governments with adequately funding research coordination and review body (Article 8).

16. h. Charge the governments with establishing joint endowed research fund (Article 5, Annex 17) with top priority given to research that monitors the effectiveness of implementation, and second priority to research that explores emerging threats or trends.

17. Strengthen Democratic Processes to Promote Enforceability and Compliance

17. a. The Agreement should specify a public petition process by which any resident of either country can claim a failure to implement the Agreement. Such petitions would be required to meet screening criteria, as judged by the IJC, to ensure that they are not frivolous or duplicative of existing litigation, and that alternative domestic procedures applicable to the petition topic have been exhausted. If a petition is valid, the Agreement should require an investigation of the petition topic by the IJC, a public response from the relevant governments, recommendations for action by the IJC, and a commitment by the governments to be bound by such recommendations.

17. b. The Agreement should contain language committing the governments to enacting its goals and objectives into national law.

17. c. All phrases that grant governments generic flexibility in implementing the Agreement, such as “shall seek to” and “will make their best efforts to” should be removed from the agreement and replaced with clear commitments by specific agencies and by specific times.

18. Citizen Participation

Advisory board participation

18. a. The agreement should specify that representatives of the Basin’s environmental groups, at least one from each country, should be appointed to the advisory boards overseen by the IJC, currently the Water Quality Board, the Science Advisory Board and the Council of Great Lakes Research Managers. Such representatives should have parity in number with representatives of industry.

18. b. Nominations for environmental group representation on the boards should be solicited from a body of all environmental groups in the Basin reasonably characterized as being regional in nature.

18. c. The Agreement should also specify that each board should have representation from the region's tribes and First Nations

Support for non-federal board members

18. d. As specified for other representatives in the IJC's Mission Statement and Guiding Principles, environmental group representatives would be expected to perform as advisors in their personal and professional capacities rather than in their organizational capacities. Any needed travel, lodging, and communication expenses incurred by environmental and Tribal / First Nations representatives should be reimbursed by the Commission.

Public participation in reporting

18. e. The IJC and the governments should assure ample opportunity for public participation in all reporting processes, particularly at the IJC biennial meetings. The Agreement should specify that IJC board priority reports and government biannual progress reports required by the Agreement be distributed at least one month before the IJC biennial meeting, and that commissioners, report authors, and government officials will all be present at the biennial meeting to accept comment and answer questions from the public.