

# Great Lakes Water Quality Board: Emerging Issues Workgroup



*“The exotics are a huge threat to the Great Lakes system...treat exotics as a pollutant, because that's essentially what they are, and they have tremendous effects on the ecosystems of these water bodies and all of the tributaries and lakes that are connected to them.”<sup>1</sup>*

*“The Agreement must address emerging chemical threats to the Great Lakes in a preventative way. This need is urgent, as certain emerging chemical threats have already been shown to adversely affect wildlife, and we still know little about synergistic, additive or interactive effects...”<sup>2</sup>*

## **Committee Overview**

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The Great Lakes Water Quality Agreement (GLWQA) expresses a bi-national commitment “to restore and maintain the chemical, physical and biological integrity of the Great Lakes Basin ecosystem.” The International Joint Commission (IJC) monitors and assesses progress under the GLWQA and advises the governments of Canada and the United States on related matters through bi-national boards.

The Great Lakes Water Quality Board is the principle advisor responsible for assisting the IJC in the functions, powers and responsibilities assigned to it under the GLWQA. The Board also carries out other special functions related to Great Lakes water quality, as requested by the IJC.

The IJC has determined that efforts to restore and protect the Great Lakes are being complicated by new emerging challenges that are not specifically addressed in the current GLWQA, thus affecting its usefulness. The IJC therefore created a Nearshore Initiative which includes a workgroup focused on issues of emerging concern. It is asking workgroup members to provide advice on one or both of the following emerging issues linked to the Great Lakes: 1) preventing and controlling aquatic invasive species, and 2) dealing with chemicals of emerging concern (e.g. pharmaceuticals and personal care products). In preparation for the anticipated renegotiation of the GLWQA in 2010, your job will be to debate, discuss and provide recommendations on the development of concrete actions with respect to these issues.

## Introduction

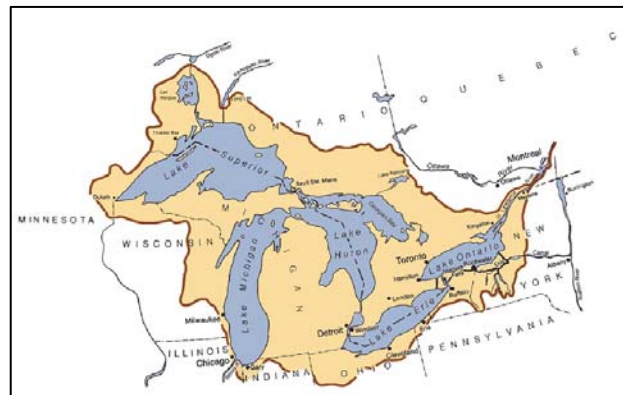
The Great Lakes are a set of five freshwater lakes connected by 5,000 rivers and streams. As the largest system of freshwater in the world, the Great Lakes contain nearly 20 percent of the world’s surface freshwater.<sup>3</sup> Only one percent of the water in the Lakes leaves the Basin each year through the St. Lawrence River (with one percent renewing itself naturally via the hydrologic cycle). This means the Great Lakes are essentially a closed system.<sup>4</sup> Water can stay in Lake Superior for up to 191 years, 99 years in Lake Michigan, 22 in Lake Huron, 6 in Lake Ontario and 2.6 in Lake Erie.<sup>5</sup> In this closed system, pollutants that find their way into the Lakes can accumulate from various sources and become concentrated over time, lasting many generations.

With the exception of Lake Michigan, the lakes straddle a border between Canada and the United States creating the need for bi-national resource management and cooperation, particularly with respect to controlling the amount and type of pollution degrading the water quality of the Great Lakes.

## Great Lakes Quality Water Agreement

### *Original Agreement & Amendments*

First signed in 1972 by US President Richard Nixon and Canadian Prime Minister Pierre Trudeau, the [GLWQA](#) is an enforceable commitment by the United States and Canada to work together to prevent, control and clean up pollution throughout the Great Lakes Basin Ecosystem. It outlines a set of objectives, rights and obligations for the two countries under the Boundary Waters Treaty of 1909.



**Map 1: Great Lakes and St. Lawrence River Basin**  
Source: [www.ijc.org/rel/boards/cde/finalreport/figure1eng.jpg](http://www.ijc.org/rel/boards/cde/finalreport/figure1eng.jpg)

The two Governments amended the original agreement in 1978, further committing to restore and maintain the chemical, physical, and biological integrity of the Great Lakes. This version adopted an ecosystem approach and called for programs designed to eliminate the release of “persistent toxic substances” which can linger in the environment.

In 1987, a Protocol was signed containing additional amendments that strengthened the programs, practices and technology mentioned in the Agreement and further increased accountability, timelines and reporting of program implementation. The new Protocol also introduced the development and implementation of remedial action plans (RAPs) for Areas of Concern (AofCs) (i.e. hot spot problem areas) as well as lakewide management plans (LAMPs) to control pollutants. In addition, Annexes containing detailed program descriptions and reporting arrangements were added for non-point contaminant sources, contaminated sediments, airborne toxic substances, contaminated groundwater, and associated research and development, among other issues.

### *Role of the International Joint Commission*

Under the terms of the GLWQA, the two federal Governments are required to implement programs and report on the progress made in restoring, preserving, protecting and cleaning up the Great Lakes. The IJC’s role is to review, monitor and assess progress under the GLWQA and advise Governments on matters related to the quality of the boundary waters of the Basin. The GLWQA also requires the IJC to

assist the Governments with joint programs under the agreement via two binational boards (the Great Lakes Water Quality Board and the Great Lakes Science Advisory Board).<sup>6</sup>

### ***Implementation***

Canadian federal-provincial commitments to coordinate resources and work collaboratively to reduce pollutants, clean up hotspots, preserve fish and wildlife habitat, and protect the biodiversity of the Great Lakes Basin are implemented through the [Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem](#) (COA). The COA was first signed in 1971, renewed in 2002, and is expected to be renegotiated in 2010.<sup>7</sup> In the United States, a strategy for Great Lakes restoration has been developed by the [US Regional Collaboration](#) to provide mechanisms that address immediate threats and coordinate water management programs.<sup>8</sup> In addition, the Great Lakes - St. Lawrence River Basin Sustainable Water Resources Agreement (previously called the 2001 Annex to the Great Lakes Charter of 1985) and the Great Lakes - St. Lawrence River Basin Water Resources Compact have the power to facilitate cooperative action among states and provinces with respect to Great Lakes water resources management.

### ***Review & Potential Renegotiation***

In 2005, the governments of Canada and the United States asked the IJC to seek public comment on how effective the GLWQA and its implementation have been over the last 30 plus years. The IJC held public meetings in cities across the Great Lakes and St. Lawrence Basin and consulted with government officials, stakeholders and the public through an interactive [web forum](#). It also received comments from over 4000 individuals and organizations by mail, phone, and online. With this information, it compiled [a report](#) in January 2006 synthesizing the recorded views and advice.

The IJC also released [a final report](#) in August 2006 containing advice to the Governments of the United States and Canada on the GLWQA, based on the comments received during the above consultation process, as well as suggestions from key experts and the Great Lakes Water Quality Board. In this report, the IJC noted that environmental and economic damage is being caused by a number of new and emerging issues of concern that are not adequately addressed in the latest GLWQA.

For example, ongoing introductions of aquatic invasive species (AIS) are significantly affecting water quality and contributing to the loss of biodiversity, as they degrade habitat, compete with native species, and disrupt natural food webs. AIS are also adding to the cost of industrial, municipal and recreational activities, and impacting economic development through trade and tourism. The report pointed out that the GLWQA does not currently address AIS sufficiently, recommending bi-national attention and coordination to control existing invasive species and prevent new ones from entering the Great Lakes Basin.<sup>9</sup>

Chemicals of emerging concern were also noted as an increasing problem requiring further research, prevention, and control. This category of pollutants includes pharmaceuticals, personal care products, and endocrine disrupting compounds, among others, which would also benefit from targeted action inserted into the GLWQA.

## Emerging Issues of Concern

### Topic 1: Aquatic Invasive Species (AIS)

#### Key Terms

**Alien species:** refer to plants, animals and micro-organisms introduced into areas beyond their natural ecosystem (also known as **non-native** or **exotic species**).

**Aquatic invasive species:** refer those alien species whose introduction and spread threatens the environment, economy or society, including human health, in detrimental ways (also known as **nuisance species**).

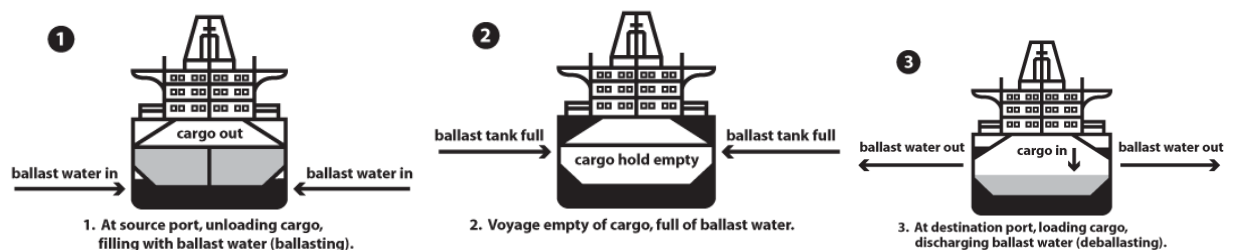
**Ballast:** defined as any solid or liquid brought on board a vessel to regulate the stability of a ship while on the ocean. Long ago, ships used solid materials such as rocks and sand for ballast, which had to be manually shoveled into cargo holds, and similarly removed when cargo was loaded on board. If not properly secured, solid ballast was prone to shifting in heavy seas causing instability. With the introduction of steel-hulled vessels and pumping technology, water became the ballast of choice because it is easily pumped in and out of tanks and, as long as tanks are kept full, poses little to no stability problems.<sup>10</sup> (see figure 1).

**Ballast water exchange:** refers to the process of releasing ballast water and pumping in new water to balance a ship once cargo has been transferred, and/or to rid ballast water tanks of alien species.

#### AIS Sources

The Great Lakes Basin is a major pathway of trade, commerce, and development. The region's population density, together with the high volume transportation of goods via shipping vessels, makes the Great Lakes region particularly vulnerable to aquatic alien (non-native or exotic) species introductions.

Alien species originating from other parts of North America or other continents can be introduced unintentionally or intentionally in a variety of ways.<sup>11</sup> The most common method is unintentional through improper shipping practices. Aquatic species can hide away and be transported thousands of kilometers in ship ballast water tanks. Without following best practices, cargo ships may carry foreign species in their tanks and unknowingly discharge them into an entirely new environment when they unload their ballast water tanks.



**Figure 1: Cross Section of Ships showing ballast tanks, cargo unloading, and ballast water cycle**

Source: GloBallast, per Transport Canada [www.tc.gc.ca/marinesafety/oep/environment/ballastwater/defined.htm](http://www.tc.gc.ca/marinesafety/oep/environment/ballastwater/defined.htm)

Alien species can also attach themselves to ship hulls, recreational boats, and other vessels and equipment and catch a free ride to a new home. They have also been known to find their way up manmade canals, dams and other water diversions, as was the case for a particularly harmful species called the Asian Carp.

In addition to unintentional pathways, non-native species can be also introduced intentionally for economic or social gain if deemed desirable for sport fishing, aquaculture, or other needs. While some new aquatic species can be introduced without issue in a controlled environment, the unauthorized release, transfer or escape of introduced non-native species does occur. Introductions can also happen from the release of aquarium fish, garden pond species, baitfish, and live food fish purchased in markets.

In the Great Lakes Basin alone, there are currently 188 known aquatic alien species,<sup>12</sup> including Asian Carp, sea lamprey, zebra mussels, round goby, waterfleas, and purple loosestrife, among others. On average one new invasive species enters the Great Lakes every eight months. Unfortunately, native species and ecosystems are not always capable of resisting infection or competition from these invaders.

### **AIS Impacts**

Approximately 10 percent of aquatic alien species are considered problematic to the economy and the environment, posing the second greatest threat to biodiversity, second only to habitat destruction.<sup>13</sup> In addition to disrupting the natural food cycle of native species, alien species can interfere with natural habitat, damage municipal and industrial infrastructure, and impact recreational and commercial fisheries and facilities. These species are considered a form of “biological pollution”. They have been found to deprive native fish of food, ignite algal growth (impacting water quality), increase outbreaks of avian botulism, foul drinking water intakes, and cause native species to become rare or endangered. As a result, clear water can transform into a weed invested zone. A lovely, scenic beach can become a hazard with dangerous surfaces, rotting algae, and serious odours. The invasion of the zebra mussel resulted in hundreds of millions of dollars spent to control the species, control and remove algae, and fix industrial and municipal water supplies clogged with mussels and/or associated algae. Another invasive species, Asian Carp, is thought to carry the potential to destroy a \$4 billion fishing industry if not adequately controlled and/or further prevented. It can be extremely difficult and costly to remove or otherwise control introduced species once established in the Great Lakes.

### **Status**

Government agencies, partner organizations, and other initiatives are working on both sides of the border to enhance and coordinate efforts to reduce invasive species introductions via ballast water and other sources. Despite increased attention, awareness building, ballast water exchange requirements in some jurisdictions, and various prevention and control strategies and programs, alien invasive species continue to arrive and spread in the Great Lakes. However, without existing efforts the volume and impacts of aquatic invasive species would no doubt be even greater and more damaging. The existing patchwork of regulations in the United States and Canada is believed to be reducing the effectiveness of prevention measures, by not enabling a common approach to combat invasions.<sup>14</sup>

Signed over twenty years ago, the GLWQA reflects the level of understanding of invasive species issues at that time, and does not recognize other pathways of alien species beyond ballast water introductions. While limited in its scope with respect to this emerging issue, the GLWQA does call for additional research to determine the impact non-native species have on water quality, fish and wildlife, and habitat; and asks Coast Guards to review their practices and procedures. While this work could be used to develop appropriate management solutions, fully including concrete AIS-related objectives and actions directly in the GLWQA is worthy of consideration, particularly as an extension of the agreement’s focus on preventing pollution (in this case biological pollution).<sup>15</sup> Binational commitments and action plans would help prevent and control further introductions in an integrated manner.

## **Topic 2: Chemicals of Emerging Concern: PPCPs**

### **Background**

The transfer of natural and human-made chemicals and substances via air, land and water is constantly changing the composition of the Great Lakes. It is estimated that 70,000 commercial and industrial compounds are now being produced, consumed and often deposited into the environment, with 1,000 more chemicals introduced each year.<sup>16</sup> Environmental concentrations of some of these chemicals have been reduced significantly due to successful management controls and actions over the last thirty years, which is a welcome good news story. However, new chemicals have been detected in the Great Lakes recently, sometimes at harmful concentrations, with misunderstood origins and unknown impacts, particularly when combined with other toxic substances.

Several new chemicals have been identified as *chemicals of emerging concern*. These chemicals occur widely in the environment and have been identified as being a potential environmental and health risk, yet little data exists to determine the risk. Chemicals of emerging concern can include brand new chemicals (hot off the production line) as well as those that have just been recently categorized as a result of test showing higher concentrations or improvements in detection technology.

The list of emerging contaminants includes: synthetic fragrances and musks, industrial and household chemicals like flame retardants and stain resistant materials, veterinary drugs, pesticides, genetically modified foods, vitamin and mineral supplements, food additives, as well as pharmaceuticals and personal care products.<sup>17</sup> Note that most of these chemicals are released from the consumption and/or disposal of *products*, not necessarily from the industrial or manufacturing *processes* that created them, which are generally perceived to be traditional sources of pollution. These products and associated substances are not currently mentioned in the GLWQA, despite negative impacts on the Lakes. As such, they represent a large emerging research and management opportunity to understand their sources and effects, and further develop appropriate strategies to prevent and clean up chemical pollution.

Pharmaceuticals and personal care products (PPCPs) are of particular note due to their relevance and pervasiveness in our everyday lives. This workgroup has narrowed the discussion of “chemicals of emerging concern” to focus on PPCPs in more detail.

### **PPCP Sources**

With a growing and aging population, and increased demand for medicine and health and personal care products, the amount of PPCP chemicals in the environment has been steadily increasing.<sup>18</sup> Most medications are excreted through human feces and urine, as well as from animals that ingest hormones and drugs to assist growth or prevent disease. PPCPs are therefore most often introduced into aquatic environments from sewage treatment plant waste or agricultural run-off. Unfortunately, today’s treatment plants do not have the capacity to remove all unwanted substances. Some chemicals can become even more biologically active than when they were consumed. Chemicals excreted as “conjugates” (combined with other chemicals to make them water soluble) are usually biologically inactive. However, once in water, they can undergo hydrolysis which can cause them to become active again. Treatment facilities, depending on the state of the technology and the chemicals in question, are not always equipped to remove these active ingredients. As a result, pharmaceuticals find their way into water bodies and directly impact food chains, habitats, and drinking water sources.<sup>19</sup>

Other sources of pharmaceuticals involve improper disposal of old or unused medications (dumped in the toilet or garbage), as well as sludge from wastewater treatment plants being spread on agricultural land as fertilizer. In addition, personal care products can be transferred to water bodies during consumption (shampoos, soaps), soon after consumption (when sunscreens, insecticides, hair jells, creams, makeup and

perfumes are washed off) or when thrown out and transported to a landfill where they can leach or seep into the groundwater sources and eventually end up in a nearby river or lake.

### **PPCP Impacts**

Some of the potential adverse impacts of PPCPs include the disruption of reproductive functions due to excessive amounts of testosterone or estrogen, as well as increased resistance to antibiotics and heightened allergic reactions. Effects can be quite pronounced among youth, elderly or allergy prone individuals, with reduced ability to remove toxics or foreign substances from their bodies, or during certain stages of life such as pregnancy.<sup>20</sup>

In terms of impacts on the Great Lakes ecosystem, some medicines contain endocrine disrupting compounds that can affect the hormone levels, growth, reproduction and development of fish and wildlife.<sup>21</sup> The toxic soup of various emerging and toxic chemicals is understudied and not well understood, adding a certain risk factor to inaction.

### **Status**

In 2008, the US Environmental Protection Agency put forward a new approach to address pharmaceuticals and personal care products (PPCPs) in water. This involves strengthening science to detect PPCPs and understand the potential sources and effects of pharmaceuticals in water. It also involves increasing public understanding, building partnerships, promoting collection opportunities, and regulations to minimize the amount of PPCPs. Unfortunately, the redesign of pharmaceuticals, so they might break down more easily in the environment or involve less toxic chemicals, has not been prioritized.

In Canada, pharmaceuticals and personal care products are both approved under the Food and Drug Act and its associated regulations. Health Canada conducts a pre-market evaluation but not an assessment of their persistence, bioaccumulation and toxicity after consumption. There is less success in regulating the impacts of PPCPs in Canada, and similarly no federal directive to regulate the disposal of these products. However, more work being done in Canada in certain provinces to promote proper disposal of medications through pharmacies and municipal depots.<sup>22</sup> Ontario is also working on phase two of its household hazardous waste diversion strategy, which will include pharmaceuticals.<sup>23</sup>

Overall, policies to date have focused on single pollution sources and contaminants in isolation. There is also a significant gap in research and information gathering, as well as prevention, which raises questions about the choices being made to manage the risks associated with chemical releases (after the fact), rather than working to avoid the risks by preventing problems from occurring.

## **Board and Workgroup**

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The Great Lakes Water Quality Board keeps informed of programs and other measures taken with respect to the implementation of the GLWQA and assesses the adequacy and effectiveness of such programs. Among its members, Environment Canada is the lead department responsible for the GLWQA on the Canadian side, while the Environmental Protection Agency leads efforts in the United States. Both countries work together as a bi-national team in partnership with provincial, state, and municipal governments to reach consensus on the Board.

From time to time, the Board establishes workgroups – including joint multi-board workgroups with the Great Lakes Science Advisory Board and Council of Great Lakes Regional Managers – to carry out its responsibilities effectively. It can enlist the cooperation of federal, provincial or state officials, experts, or others in the United States and Canada, where appropriate, as well.

In this case, the Great Lakes Water Quality Board, under its Nearshore Initiative, seeks to establish a workgroup on emerging issues in the nearshore zone of the Great Lakes. Members of this workgroup must decide whether or not management, prevention and control of aquatic invasive species and/or chemicals of emerging concern ought to be included as additional annexes in a new GLWQA and what recommendations they would share with the IJC to containing draft advice on management objectives and action plans for these emerging issues.

## **Positions**

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In representing the following positions, members of the Great Lakes Water Quality Board – Emerging Issues Workgroup will research their positions and express their respective viewpoints and advice during the sessions. This is a “general assembly” format where issues and advice are raised and discussed among the members of the Great Lakes Water Quality Board (and other joint Boards), who have been invited to participate in this workgroup. Full participation by all members is desirable for the Board to carry out its responsibilities. From time to time, others may be invited to the table to provide advice and suggestions.

### **A. Co-Chairs & Federal Government Representatives**

The Great Lakes Water Quality Board generally consists of an equal number of members from the United States and Canada appointed by the IJC in consultation with government officials.

### **B. Provincial & State Government Representatives**

In addition to members from each of the Federal Governments, the Board includes at least one member from each of the governments of the eight states (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Wisconsin and Pennsylvania) and two provinces (Ontario and Quebec) within the Great Lakes Basin. Members would consult their respective departments and ministries (with varying viewpoints) in preparation for the meetings. Any of these members could participate in a GLWQA-related workgroup.

### **C. Staff, Experts & Members of the Public**

As required, administrative support, public information services and technical assistance to the Board is provided by the IJC's Great Lakes Regional Office in Windsor, Ontario. This includes appointing a

member of the Regional Office staff to be the Secretary of the Board. Generally each workgroup would have one or more IJC staff members. Researchers, other experts and stakeholder representatives may be invited to assist and/or advise IJC staff and government officials. To the greatest extent possible, the Board publicizes its activities and may permit members of the public to attend meetings of the Board and its workgroup sessions.

## Questions to Consider

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### General

1. Which issues should the IJC concern itself with under the umbrella of protecting the quality of the Great Lakes? During possible upcoming renegotiations of the GLWQA, should invasive species and chemicals of emerging concern have their own Annexes? Why?
2. Given the breadth of demands, challenges and jurisdictions impacting pollution levels, do bi-national agreements like the GLWQA quantifiably help to protect the Great Lakes?
3. Currently the GLWQA only includes the St. Lawrence River up to the border between Canada and the United States (near Cornwall, Ontario and Massena, New York). Is this consistent with the ecosystem approach adopted in the agreement in 1978? What would be the benefit to these emerging issues of including the St. Lawrence River in its entirety in the GLWQA?

### Aquatic Invasive Species (AIS)

1. What are the most effective prevention, detection, control and response measures? Is prevention of AIS a realistic approach given the multitude of sources? Describe the trade-off between preventing new introductions and trying to control them once introduced.
2. Should chemicals be used to kill aquatic invasive species? How do various treatment techniques impact native species and habitats? What factors should be considered when making a decision to treat or otherwise eliminate certain species from an environment?
3. Are there benefits to some alien species? Who decides whether an alien species is invasive? What criteria are used to make that decision? Which interests are prioritized?
4. Who should pay for prevention, inspection and control of aquatic invasive species transported within or on ocean vessels? What circumstances would require a shutdown of the seaway?
5. To what extent should a rapid response be put in place to deal with the spread of alien species?
6. Is management of invasive species currently prioritized in the Great Lakes region? Why or why not? What factors contribute to the status quo?

### Pharmaceuticals and Personal Care Products (PPCPs)

1. What are some of the most viable solutions to preventing, controlling and treating contamination from PPCPs? How would you evaluate different upstream (at the source, up the pipe) solutions versus downstream (end of pipe) solutions? What factors/interests should you take into account?
2. To what extent should the IJC and various governments be involved in controlling elements of the production, consumption and disposal of PPCPs in an effort to protect the environment?
3. Should governments and industry be more engaged and involved in testing and assessing the environmental impacts of chemical manufacturing before being released to the public?
4. How can we successfully encourage and support extended producer responsibility? What are the barriers? Is this also the role of federal/provincial/state governments (carrot and stick) or should industry and consumers decide via the market?
5. What role do consumers play in reducing the amount of PPCPs in the Great Lakes?

\* Please make a note of other questions that could be shared for consideration and debate.

## Position Paper

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Once positions and roles are assigned, participants will be asked to prepare a short position paper on the Great Lakes Water Quality Agreement and the emerging water quality issues and solutions associated with aquatic invasive species and pharmaceuticals and personal care products.

## Suggested Resources

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### Great Lakes Water Quality Agreement

- GLWQA: [www.ijc.org/rel/agree/quality.html](http://www.ijc.org/rel/agree/quality.html)
- History of the GLWQA as FYI: [www.on.ec.gc.ca/greatlakes/default.asp?lang=En&n=C6B9C389-1](http://www.on.ec.gc.ca/greatlakes/default.asp?lang=En&n=C6B9C389-1)
- US EPA & Env Canada (2007). *State of the Great Lakes Conference (SOLEC) Highlights*. [http://binational.net/solec/English/sog12007highlights\\_en.pdf](http://binational.net/solec/English/sog12007highlights_en.pdf)
- Great Lakes Water Quality Board: [www.ijc.org/conseil\\_board/water\\_greatlakes/en/glwqb\\_mandat\\_mandat.htm](http://www.ijc.org/conseil_board/water_greatlakes/en/glwqb_mandat_mandat.htm)
- GLWQA Priorities 2007-2009: <http://ijc4.securesites.net:8080/glro/glro-web/priorities/2007-09/>

### IJC - GLWQA Review

- Guide to the GLWQA: [www.ijc.org/en/activities/consultations/glwqa/guide2bw.pdf](http://www.ijc.org/en/activities/consultations/glwqa/guide2bw.pdf)
- IJC Great Lakes Water Quality Biennial Reports: [www.ijc.org/en/publications/rpts\\_bi.htm](http://www.ijc.org/en/publications/rpts_bi.htm)
- GLWQA Review Public Comments: [www.ijc.org/en/activities/consultations/glwqa/synth.php](http://www.ijc.org/en/activities/consultations/glwqa/synth.php)
- Advice to Governments on their Review of the GLWQA (2006): [www.ijc.org/php/publications/pdf/ID1603.pdf](http://www.ijc.org/php/publications/pdf/ID1603.pdf)
- Final Agreement Review Report on the GLWQA (2007): [http://binational.net/glwqa\\_2007\\_e.html](http://binational.net/glwqa_2007_e.html)
- Other resources: <http://www.canamglass.org/glwqa/>

### Perspectives on the GLWQA

- Pollution Probe: [www.pollutionprobe.org/Reports/greatlakesagreement.pdf](http://www.pollutionprobe.org/Reports/greatlakesagreement.pdf)
- Brookings Institution: [www.cgli.org/sustainable/GrtLakesCostBenefit.pdf](http://www.cgli.org/sustainable/GrtLakesCostBenefit.pdf)
- Canadian Environmental Law Association: [www.cela.ca/collections/water/great-lakes-water-quality-agreement](http://www.cela.ca/collections/water/great-lakes-water-quality-agreement)
- Great Lakes United: [www.glu.org/en/campaigns/healthy\\_waters/glwqa](http://www.glu.org/en/campaigns/healthy_waters/glwqa)
- Chiefs of Ontario: <http://chiefs-of-ontario.org/PageContent/Default.aspx?SectionHeadlineID=96>

### Aquatic Invasive Species

- GLWQ Board (2004). *Alien Invasive Species & Biological Pollution of the Great Lakes Ecosystem*. [www.ijc.org/rel/pdf/ais.pdf](http://www.ijc.org/rel/pdf/ais.pdf)
- AIS & GLWQA, p. 22-27. [www.canamglass.org/glwqa/files/AgrmntRevEnvirCmntyDiscPaperfinal.pdf](http://www.canamglass.org/glwqa/files/AgrmntRevEnvirCmntyDiscPaperfinal.pdf)
- Ontario MNR: [www.mnr.gov.on.ca/en/Business/Biodiversity/2ColumnSubPage/STEL02\\_167267.html](http://www.mnr.gov.on.ca/en/Business/Biodiversity/2ColumnSubPage/STEL02_167267.html)
- US EPA - Invasive Species: <http://www.epa.gov/glnpo/invasive/index.html>
- IJC Rapid Response Policy Framework: <http://ijc4.securesites.net:8080/glro/glro-web/priorities/2007-09/AIS>
- Reid, D. et al. (2007) – best practices for ballast mgmt: [www.ijc.org:8080/glro/glro-web/priorities/2007-09/AIS/NOBOB-BFinalReportJune2007.pdf](http://www.ijc.org:8080/glro/glro-web/priorities/2007-09/AIS/NOBOB-BFinalReportJune2007.pdf)
- COA: [www.ene.gov.on.ca/envision/water/greatlakes/coa/Invaders\\_EN.pdf](http://www.ene.gov.on.ca/envision/water/greatlakes/coa/Invaders_EN.pdf)
- Transport Canada. *Ballast water*. [www.tc.gc.ca/marinesafety/oep/environment/ballastwater/defined.htm](http://www.tc.gc.ca/marinesafety/oep/environment/ballastwater/defined.htm)
- Great Lakes Commission - Great Lakes Panel on Aquatic Nuisance Species: [www.glc.org/ans/panel.html](http://www.glc.org/ans/panel.html)
- GL St. Lawrence Seaway System: [www.greatlakes-seaway.com/en/environment/ballast-water/index.html](http://www.greatlakes-seaway.com/en/environment/ballast-water/index.html)
- Environment Canada (2004). *Alien Invasive Species Strategy for Canada*. [www.ec.gc.ca/eee-ias/default.asp?lang=En&n=98DB3ACF-1](http://www.ec.gc.ca/eee-ias/default.asp?lang=En&n=98DB3ACF-1)
- Commissioner of Environment & Sustainable Development. *Control of Aquatic Invasive Species*. [www.oag-bvg.gc.ca/internet/docs/aud\\_ch\\_cesd\\_200803\\_06\\_e.pdf](http://www.oag-bvg.gc.ca/internet/docs/aud_ch_cesd_200803_06_e.pdf)
- Great Ships Initiative: [www.nemw.org/GSI/index.htm](http://www.nemw.org/GSI/index.htm)
- GLIN links on AIS: [www.great-lakes.net/envt/flora-fauna/invasive/invasive.html](http://www.great-lakes.net/envt/flora-fauna/invasive/invasive.html)
- International Association for Great Lakes Research: [www.iaglr.org/scipolicy/issues/ais.php](http://www.iaglr.org/scipolicy/issues/ais.php)

## Chemicals of Emerging Concern - PPCPs

- Presentation on IJC Consultation re: CECs (2009): <http://epa.gov/bns/reports/march2009/IJCon033109.pdf>
- US EPA – PPCPs: [www.epa.gov/ppcp/basic2.html](http://www.epa.gov/ppcp/basic2.html)
- IJC (2002). *Pharmaceuticals in the Environment*. [www.ijc.org/rel/pdf/09\\_Pharma-fall2002.pdf](http://www.ijc.org/rel/pdf/09_Pharma-fall2002.pdf)
- Campaign for Safe Cosmetics: [www.safecosmetics.org/](http://www.safecosmetics.org/)
- Eco Justice: [www.ecojustice.ca/publications/submissions/glwq\\_acomments\\_sierralegal\\_dec\\_05.pdf](http://www.ecojustice.ca/publications/submissions/glwq_acomments_sierralegal_dec_05.pdf)
- [www.peer.org/docs/ma/Paper\\_on\\_PPCPs\\_and\\_EDCs.pdf](http://www.peer.org/docs/ma/Paper_on_PPCPs_and_EDCs.pdf)
- Post Consumer Pharmaceutical Stewardship Association: [www.medicationsreturn.ca/](http://www.medicationsreturn.ca/)

## GENERAL LINKS

- *International Joint Commission*: <http://www.ijc.org/>
- *Boundary Waters Treaty*: <http://bwt.ijc.org/>
- *Great Lakes Commission*: <http://www.glc.org/>
- *Great Lakes Information Network*: <http://www.great-lakes.net/>
- *Great Lakes Environmental Research Laboratory*: <http://www.glerl.noaa.gov/>
- *US Env. Protection Agency (EPA) - Great Lakes National Program*: <http://www.epa.gov/greatlakes/index.html>
- *State of the Great Lakes Conference (SOLEC)*: <http://www.epa.gov/solec/>
- *US EPA - The Great Lakes: Environmental Atlas & Resource Book*: <http://www.epa.gov/glnpo/atlas/index.html>
- *Great Lakes Regional Office (IJC)*: <http://www.ijc.org:8080/glro>

## ENDNOTES

- <sup>1</sup> [www.ijc.org/en/activities/consultations/glwqa/synth\\_4.php?#32b](http://www.ijc.org/en/activities/consultations/glwqa/synth_4.php?#32b)
- <sup>2</sup> IJC Public Comments [www.ijc.org/php/publications/pdf/ID1588.pdf](http://www.ijc.org/php/publications/pdf/ID1588.pdf)
- <sup>3</sup> [www.ijc.org/en/activities/consultations/glwqa/guide2bw.pdf](http://www.ijc.org/en/activities/consultations/glwqa/guide2bw.pdf)
- <sup>4</sup> Safe Drinking Water Foundation, [www.safewater.org](http://www.safewater.org)
- <sup>5</sup> [www.ijc.org/en/activities/consultations/glwqa/guide2bw.pdf](http://www.ijc.org/en/activities/consultations/glwqa/guide2bw.pdf)
- <sup>6</sup> [www.ijc.org/rel/agree/quality.html](http://www.ijc.org/rel/agree/quality.html)
- <sup>7</sup> Environment Canada. [www.on.ec.gc.ca/greatlakes/default.asp?lang=En&n=EE1B7E6A-1](http://www.on.ec.gc.ca/greatlakes/default.asp?lang=En&n=EE1B7E6A-1) and Ontario Ministry of the Environment [www.ene.gov.on.ca/en/water/greatlakes/coa/index.php](http://www.ene.gov.on.ca/en/water/greatlakes/coa/index.php)
- <sup>8</sup> [www.ijc.org/en/activities/consultations/glwqa/guide2bw.pdf](http://www.ijc.org/en/activities/consultations/glwqa/guide2bw.pdf)
- <sup>9</sup> IJC (2007). [www.ijc.org/php/publications/pdf/ID1603.pdf](http://www.ijc.org/php/publications/pdf/ID1603.pdf)
- <sup>10</sup> Transport Canada. [www.tc.gc.ca/marinesafety/oep/environment/ballastwater/defined.htm](http://www.tc.gc.ca/marinesafety/oep/environment/ballastwater/defined.htm)
- <sup>11</sup> Environment Canada. [www.ec.gc.ca/eee-ias/default.asp?lang=En&n=98DB3ACF-1](http://www.ec.gc.ca/eee-ias/default.asp?lang=En&n=98DB3ACF-1)
- <sup>12</sup> [www.greatlakesdirectory.org/Michigan/040309.htm](http://www.greatlakesdirectory.org/Michigan/040309.htm)
- <sup>13</sup> SOLEC (2007). [http://binational.net/solec/English/sogl2007highlights\\_en.pdf](http://binational.net/solec/English/sogl2007highlights_en.pdf)
- <sup>14</sup> IJC [www.ijc.org/en/activities/consultations/glwqa/guide2bw.pdf](http://www.ijc.org/en/activities/consultations/glwqa/guide2bw.pdf)
- <sup>15</sup> [www.canamglass.org/glwqa/files/AgrmntRevEnvirCmntyDiscPaperfinal.pdf](http://www.canamglass.org/glwqa/files/AgrmntRevEnvirCmntyDiscPaperfinal.pdf)
- <sup>16</sup> Env Canada <http://www.on.ec.gc.ca/greatlakes/default.asp?lang=En&n=82549F17-1>
- <sup>17</sup> SOLEC (2007).
- <sup>18</sup> IJC (2002) [www.ijc.org/rel/pdf/09\\_Pharma-fall2002.pdf](http://www.ijc.org/rel/pdf/09_Pharma-fall2002.pdf)
- <sup>19</sup> IJC (2002)
- <sup>20</sup> [www.mcmaster.ca/mieh/documents/COC\\_Report\\_Update.pdf](http://www.mcmaster.ca/mieh/documents/COC_Report_Update.pdf)
- <sup>21</sup> [www.ijc.org/en/activities/consultations/glwqa/others\\_kingston\\_3.php](http://www.ijc.org/en/activities/consultations/glwqa/others_kingston_3.php)
- <sup>22</sup> [www.medicationsreturn.ca/](http://www.medicationsreturn.ca/)
- <sup>23</sup> Waste Diversion Ontario [www.wdo.ca](http://www.wdo.ca)