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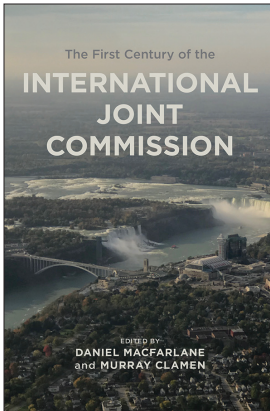
Macfarlane, D., & Clamen, M. (2020). The First Century of the International Joint Commission. [pps. 1-625.] University of Calgary Press, University of Calgary, AB.

<http://hdl.handle.net/1880/111575>

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THE FIRST CENTURY OF THE INTERNATIONAL JOINT COMMISSION

Edited by Daniel Macfarlane and Murray Clamen

ISBN 978-1-77385-108-2

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The Great Lakes Remedial Action Plan Program: A Historical and Contemporary Description and Analysis

Gail Krantzberg

The Great Lakes and other lakes and rivers in the basin provide drinking water to millions. On both sides of the border, the basin supports multi-billion-dollar manufacturing, service, tourism, and outdoor recreation industries, as well as strong maritime transportation systems and diversified agricultural sectors. It provides the foundation for trade between Canada and the United States, equaling approximately 50 per cent of Canada's annual trade with the United States. Each year, the Great Lakes region contributes \$180 billion to Canada-US trade. The Great Lakes region includes eight states (Minnesota, Wisconsin, Illinois, Indiana, Michigan, New York, Ohio, and Pennsylvania) and two Canadian provinces (Ontario and Quebec) The area is home to 107 million people, 51 million jobs, and a GDP of US\$6 trillion.¹

Degradation of environmental quality directly damages the viability and vigour of the region. The reliance of the economy on a healthy Great Lakes basin ecosystem is unequivocal and the imperative to restore ecosystem health is clear. To strive for a sustainable future, social and ecological and economic interests must be integrated. As Constanza asserts, sustainability can be defined as a balanced relationship between the

FIGURE 12.1.1. Location and status of the Areas of Concern. Used with permission of Binational.net.

AOC	Restrictions on fish & wildlife consumption	Tainting of fish & wildlife flavor	Degraded fish & wildlife populations	Fish tumor or other deformities	Bird & animal deformities or reproduction	Degradation of benthos	Restrictions on dredging activities	Eutrophication or undesirable algae	Restrictions - drinking water consumption, taste/odor problems	Beach Closings	Degradation of aesthetics	Added costs to agriculture or industry	Degradation of phyto- and zoo- plankton	Loss of fish and wildlife habitat
Thunder Bay		★ 1995		★ 1995		■ ★ 2016	★ 2012			■	★ 2019	★ 2004		■ ★ 2016
Nipigon Bay (Delisting Pending)				★ 2010		★ 1998	★ 1995	★ 2016			★ 2016			■
Jackfish Bay (In Recovery)			■			◆	★ 2012							
Peninsula Harbour	■			■		■	◆	★ 2018		★ 2018	★ 2018	★ 1999		■
St. Mary's River	■		■			■	◆			★ 1999				
Spanish Harbour (In Recovery)	■		★ 1999			■	◆			★ 2018		★ 1999		
Sewern Sound (Delisted 2003)	★ 2002		★ 2002		★ 1994	★ 1994	★ 2002	★ 2002		★ 1994	★ 1994		★ 1994	★ 2002
Collingwood Harbour (Delisted 1994)	★ 1994		★ 1994		★ 1994	★ 1994	★ 1994	★ 1994		★ 2018	★ 2016	★ 2012		■
St. Clair River	■					■	★ 2018		■	★ 2016	★ 2016	★ 2010		■
Detroit River	■	★ 2014	■	◆	■	◆	★ 2019		★ 2010					■
Wheatley Harbour (Delisted 2010)	★ 2010		★ 2010		★ 2009	■	★ 2010	★ 2010		■				■
Niagara River	■		■			■	★ 2009			■				■
Hamilton Harbour	■		◆			■	■	■		■	◆			■
Toronto and Region	■		■			★ 2016	★ 2016	■		■				■
Port Hope Harbour	■						■							■
Bay of Quinte	■		★ 2018			★ 2018	★ 2017	■	◆	★ 2019	■		■	★ 2018
St. Lawrence River	■		■			★ 2007	★ 2007	■	★ 1997	◆	★ 1997	★ 1997		■

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dynamic human economic systems and the dynamic but generally slower-changing ecological systems in which: 1) human life can continue indefinitely; 2) people can flourish, 3) cultures can develop, but within such bounds that human activities do not destroy the diversity, complexity, and function of the ecological life-support system.² Sustainable Great Lakes resilience requires, then, socio-ecological governance of the system.

As consumerism and industrial production are on the rise, non-renewable and renewable natural resources are being used more frequently in order to satisfy human desires. As described by de Boer and Krantzberg,

Robert Hennigan at the Thirteenth Conference on Great Lakes Research expressed that there is a requirement for understanding and reform of the Great Lakes institutional ecosystem to establish an attainable and workable system for effective water management. Incorporation of the action elements of persuasion and education, legal action and economic incentives were noted as being particularly necessary for the success of this system.³

This insight still holds, and it calls on stakeholders to regard the water management issue as an integrated governance challenge and not a compilation of programs and policies applied reactively to address insults to the system.⁴

Binational Accords and Events

The United States of America and His Majesty the King of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas, Emperor of India, being equally desirous to prevent disputes regarding the use of boundary waters and to settle all questions which are now pending between the United States and the Dominion of Canada involving the rights, obligations, or interests of either in relation to the other or to the inhabitants of the other, along their common frontier, and to make provision for the

adjustment and settlement of all such questions as may hereafter arise, have resolved to conclude a treaty in furtherance of these ends, and for that purpose have appointed as their respective plenipotentiaries.

—Boundary Waters Treaty⁵

The 1909 Boundary Waters Treaty stated that “boundary waters and water flowing across the boundary shall not be polluted on either side to the injury of health or property on the other.” The treaty created the International Joint Commission (IJC) to prevent and resolve disputes over the use of boundary waters and to deal with boundary tensions between the two nations. Further, article ix of the treaty goes on to specify that the IJC can investigate a specific transboundary issue under a formal request by both governments (worked out bilaterally) termed a “reference.” Using this provision, the United States and Canada issued a joint reference in 1964 to the IJC to investigate pollution in Lake Erie and elsewhere on the lower lakes, perhaps as a result of the growing public and scientific concern about water pollution in North America after the Second World War.⁶

One of the earliest IJC dockets, this reference was focused on water quality, particularly on eutrophication in the lower Great Lakes (see Jamie Benidickson’s chapter in this collection), and interest in water quality that intensified after the Second World War (which Jennifer Read covers in her chapter in this collection). A 1966 detailed investigation of pollution problems in Lakes Erie and Ontario and the St. Lawrence River resulted in an in-depth report on water quality and the recommendation for an international lower lakes clean-up effort focused on the role of phosphorus in eutrophication. The report eventually resulted in the signing of the Great Lakes Water Quality Agreement in 1972. The agreement coordinated an international clean-up effort to enhance the water quality of the Great Lakes. The IJC became actively involved in analyzing and disseminating information. The commission advised both governments on effectiveness of programs and provided water quality updates.

In 1978, the Canadian and US governments reviewed the agreement of 1972 and revised it to reaffirm the commitment of each country to

restore and maintain the chemical, physical, and biological integrity of the Great Lakes basin ecosystem. Even more comprehensive than the original agreement, the 1978 Great Lakes Water Quality Agreement placed greater emphasis on the management of toxic substances, dredging and shipping regulations, and continuation of the phosphorus control program started in 1972.

Since 1973, the Great Lakes Water Quality Board (WQB), the principal policy advisors to the IJC, in its annual assessments of water quality, identified Areas of Concern (originally called Problem Areas) where Great Lakes Water Quality Agreement objectives have been exceeded and where such exceedance has caused or is likely to cause impairment of beneficial use or the area's ability to support aquatic life.⁷

The WQB, in its 1977 annual report, again listed the problem areas; described the nature of the problem; identified dischargers of one or more substances that were probably causing the problem; and commented on progress toward compliance with jurisdictional enforcement programs. The report also described remedial programs in the drainage basin of each problem area and progress toward meeting boundary water quality objectives. In 1983 the WQB determined that classifying Areas of Concern was difficult due to the lack of specificity of the criteria used to classify the areas and the guidelines to be used for their evaluation. This led to difficulties in data interpretation for the purpose of defining the problems and deducing trends in environmental quality. In order to overcome these difficulties, the board developed a procedure for data assessment and identification of Areas of Concern (AOC). The unique experiment in place-based remediation and protection called for in the 1987 protocol emerged directly from recommendations made by the WQB.⁸

In 1987, a protocol was signed amending the 1978 agreement. The amendments were aimed at strengthening the programs, practices, and technology described in the 1978 agreement and to increase accountability for their implementation. Timetables were set for implementation of specific programs. New annexes addressed atmospheric deposition of toxic pollutants, contaminated sediment, groundwater, and non-point sources of pollution. Annexes were also added to incorporate the development and implementation of Remedial Action Plans (RAPs) for the various AOC and Lakewide Management Plans to control critical pollutants.

Annex 2 of the 1987 Great Lakes Water Quality Agreement (GLWQA)

In 1985, the WQB reported that a clear method of measuring progress in AOC implementation or removing a place from the AOC list (known as “delisting”) was absent. The WQB created a process for AOC development and implementation with categories that identify the status of the information database, ongoing programs to fill in information gaps, and the extent of remedial efforts directed at addressing specific use impairments. Hartig and Thomas pointed out that early in the program establishment, the development of RAPs represented a challenging departure from most historical pollution control efforts, where separate programs for regulation of municipal and industrial discharge, urban run-off, and agriculture run-off were implemented without considering overlapping responsibilities or whether they would be adequate to restore beneficial uses.⁷ This new process called upon the talents available in a wide array of programs far beyond those traditionally associated with water pollution control, including the involvement of local communities and a wide range of agencies at all government levels. All programs, agencies, and communities affecting an AOC were to come together to work on common goals and objectives in the RAP.

The location and status of the geographic AOCs is presented in Figure 12.1. Originally, the Province of Ontario had 17 AOCs, the state of Michigan had 14, the state of Wisconsin had 4, Ohio had 4, and New York had 6; St. Louis River/Bay is the only AOC in Minnesota, Waukegan Harbor is the only AOC in Illinois, and the Grand Calumet River/Indiana Harbor is the only AOC in Indiana.

Annex 2 in the 1987 protocol identifies fourteen Beneficial Use Impairments and initiated programs to restore these uses to the Great Lakes. These are:

1. restrictions on fish and wildlife consumption;
2. tainting of fish and wildlife flavour;
3. degradation of fish wildlife populations;
4. fish tumors or other deformities;

FIGURE 12.2. RAP review process for delisting AOCs.

AOC	Restrictions on fish & wildlife consumption	Tainting of fish & wildlife flavor	Degraded fish & wildlife populations	Fish tumor or other deformities	Bird & animal deformities or reproduction problems	Degradation of benthos	Restrictions on dredging activities	Eutrophication or undesirable algae	Restrictions - drinking water consumption, taste/odor problems	Beach Closings	Degradation of aesthetics	Added costs to agriculture or industry	Degradation of phyto- and zoo- plankton	Loss of fish and wildlife habitat
Waukegan Harbor	■					* 2018	* 2014			* 2011			■	* 2013
Grand Calumet River	■	■	■	■	■	■	■	■	* 2012		■	* 2011	■	■
Clinton River	■		■			■	■	■		■	◆			■
Deer Lake	* 2014				* 2011			* 2011						
Detroit River	■	* 2013	■	■		■	■		* 2011	■	■			■
Kalamazoo River	■		■		■	■	■			* 2011	* 2012			■
Manistique River	■					* 2007	■			* 2010				* 2008
Muskegon Lake	* 2013		■			■	* 2011	■	* 2013	* 2015	■			
River Raisin	■		* 2015		■			* 2013	* 2013	* 2013	* 2012			* 2015
Rouge River	■		■	■		■	■	■		■	■			■
Saginaw River & Bay	■	* 2008	■		■	■	■	■	* 2006	■	■		■	* 2014
Torch Lake	■			* 2007		■								
White Lake	* 2013		* 2014			* 2012	* 2011	* 2012	* 2014		* 2014			* 2014
St. Clair River	■	* 2010		* 2017	* 2015	* 2011			■	* 2016	* 2012	* 2012		* 2017
St. Marys River	■		◆	■	* 2014	■	* 2018	* 2017		* 2016	* 2014			◆
Menominee River	* 2018		* 2019			* 2017	* 2017			* 2011				* 2019
Buffalo River	■	■	■	■	■	■	■				* 2018			■
Eighteenmile Creek	■		■		■	■	■							
Oswego River	* 2006		* 2006					* 2006						* 2006
Rochester Embayment	■	* 2018	■	* 2015	■	* 2017	* 2019	◆	* 2011	◆	■	* 2011	* 2016	■
Niagara River	■		■	* 2016	■	■	■							■
St. Lawrence River	■		■		■	■							* 2015	■
Ashtabula River	* 2014		* 2014	◆		* 2018	■							* 2014
Black River	* 2017		■	■		■	■	* 2017		■	■			■
Cuyahoga River	* 2019		■	■		■	■	■		■	* 2018			■
Maumee River	■		■			■	■			■	■	* 2015		■
Presque Isle				* 2013			* 2007				■			
Fox River/S Green Bay	■	■	■	■	■	■	■	■	■	■	■		■	■
Milwaukee Estuary	■		■	■	■	■	■	■		■	■		■	■
Sheboygan River	■		■		■	■	* 2015	* 2016					■	■
St. Louis River & Bay	■		■	* 2019		■	■	■		■	* 2014			■

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5. bird or animal deformities or reproduction problems;
6. degradation of benthos;
7. restrictions on dredging activities;
8. eutrophication or undesirable algae;
9. restrictions on drinking water consumption, or taste and odour problems
10. beach closings;
11. degradation of aesthetics;
12. added costs to agriculture or industry;
13. degradation of phytoplankton and zooplankton populations; and
14. loss of fish and wildlife habitat.⁹

In the 1985 *Report on Great Lakes Water Quality*, a jurisdictional schedule for submission of RAPs was presented.¹⁰ The jurisdictions reported that all 42 RAPs would be completed by December 1986. As was concluded at a forum for RAP coordinators in October 1986, the jurisdictions underestimated the time and resources necessary to develop RAPs.¹¹ As of 2019, RAPs continue to be implemented across the basin. At present the United States has delisted four AOCs: Oswego River, Presque Isle Bay, White Lake, and Deer Lake, while Canada has delisted three: Severn Sound, Collingwood Harbour, and Wheatley Harbour. Further progress is illustrated in Tables 1 and 2 (titled Table 3 in the *Progress Report of the Parties*, available at binational.net).

The Great Lakes Water Quality Agreement protocol of 2012, which is covered in more detail in this volume by Johns and VanNijnatten, reaffirmed the parties' commitment to implement RAPs under the new Annex 1, which retained the content of the Annex 2 from 1987 and added guidance of designating Areas of Concern in Recovery (which will be discussed further below). The agreement calls for the federal governments, in co-operation with state and provincial governments, to ensure the public is consulted throughout the development and implementation

FIGURE 12.3. Collingwood Harbour was designated as an AOC in 1987. Major environmental concerns in the area included nuisance growth of algae in the harbour and contaminated sediment.

A critical component of the restoration of Collingwood Harbour was to reduce the concentration of phosphorus and control eutrophication (excessive nutrients that can cause algae growth). Technical solutions focused on optimizing phosphorous removal at the Collingwood Sewage Treatment Plant through an innovative demonstration project. The technology achieved an effluent quality comparable to that of tertiary treatment - the highest level of treatment generally used in highly sensitive ecosystems - but at less than 10% of the cost. In response to the loading reductions, the harbour is no longer eutrophic.

In November 1992, a demonstration project was initiated to safely remove sediment contaminated with heavy metals using the Pneuma pump innovative dredge technology. The sediment was piped into a confined disposal facility. The successful demonstration led to a full-scale cleanup in the harbour in 1993. This rehabilitated the degraded benthic community, removed deleterious substances, and allowed the lifting of restrictions on navigational dredging. This was the first time this technology was used in North America, and the cleanup marked a crucial step towards the restoration of the harbour. The cost of the demonstration and cleanup was \$635,000, and 7,300 cubic metres of contaminated sediment were removed.

Actions were also taken to protect the existing 96-hectare Collingwood Wetland Complex, control the invasion of Purple Loosestrife in the wetlands, and rehabilitate fish and wildlife habitat in the harbour and the watershed. Bass and pike spawning and rearing habitat were created, habitat was improved for osprey, water birds, amphibians and reptiles, and a community volunteer network was mobilized to monitor wildlife populations. The Black Ash Creek Rehabilitation Project was designed to prevent erosion while incorporating habitat rehabilitation in a natural, bioengineering approach to bank stabilization. Fish and wildlife populations responded to the initiatives, with increased numbers being documented for the first time in more than 30 years.

A strong emphasis was also placed on pollution prevention. The Greening of Collingwood became a community-based action plan targeted at pollution prevention for residents, businesses and industries. The first comprehensive “Green Home Tune-ups” in Ontario were completed in Collingwood in 1994, with the establishment of a green enterprise named the Environment Network, still very much in action.

One of the most novel projects designed to raise awareness of the importance of pollution prevention was the creation of the environmental theme park ENVIROPARK. Situated in Sunset Point Park, this unique network of play structures was designed to instill in children an understanding of how everyday life has a direct impact on our environment.

Following environmental monitoring, it was determined that environmental conditions in the area had been restored, and Collingwood Harbour became the first AOC to be delisted in 1994

FIGURE 12.4. Presque Isle Bay Case Study

YEAR	CRITICAL ACTIONS
2013	Presque Isle Bay is delisted from the Great Lakes Areas of Concern.
2012	Stage III of the RAP is completed—one of the final steps in delisting an AOC. While the rate of external growths remains a problem throughout Lake Erie, the rates of fish liver tumors in the bay has declined to the point where they are the same as the least impacted reference site in the Lake. For this reason, the fish tumor impairment is removed. The remaining beneficial use impairment is removed. A sediment analysis report is completed which evaluates the contaminated sediment in terms of ecological health and human health risks. The study took place between 2006 and 2009.
2007	The first beneficial use impairment is removed after studies reflect that bay sediment contains low levels of PAHs and fewer heavy metals.
2004-2007	Samples are collected at four locations near the AOC to determine if the incidence of fish tumors, both internal and external, had decreased. Results indicate a decline in tumors.
1992	The first stage of the Remedial Action Plan is published.
1991	Presque Isle Bay is listed as an Area of Concern.

of the RAPs.¹² Despite organizational and fiscal resource hurdles, there are notable advances in remediation and prevention programs. Essential elements that characterize successful initiatives include true participatory decision-making, a clearly articulated and shared vision, and focused and deliberate leadership.¹³ These are discussed further below.

An Ecosystem Approach for RAP Development and Implementation

An “ecosystem approach” means an integrated set of policies and managerial practices that relate people to ecosystems of which they are part—rather than to external resources or environments with which they interact.¹⁴ The identifying characteristics include: synthesis (integrated knowledge); a holistic perspective interrelating systems at different levels of integration; and actions that are ecological, anticipatory, and ethical in respect of other systems of nature.

Adopting an ecosystem approach would require three changes: re-framing the planning problem, creating an integrative knowledge base, and institutionalizing multi-stakeholder participation in decision-making.¹⁵ RAPs were a departure from water quality remediation plans to a watershed-based management context that would consider a broad array of human actions that affect water and ecosystem quality. Ecosystem-based action plans address remedial actions to restore degraded conditions, and would also inquire into the human dimensions that consider changing human behaviours that enable long-term functionality and sustainability of the ecosystem. Discovering such methods necessitated an integrative understanding of the watershed’s biochemical-physical functions and their susceptibility to anthropogenic stresses. Kellog asserts that to be successful would necessitate collaboration of all representative jurisdictions, regulatory and resources agencies, and other stakeholders and citizens in the watershed.¹⁶

Hartig points out that there is no single best way to implement an ecosystem approach, since each defined AOC involves distinct physiochemical and biological factors, stakeholders, institutional frameworks, regulatory

complexity, and more.¹⁷ An implementation framework that is guided by eight criteria should include:

1. stakeholder involvement;
2. leadership;
3. information and interpretation;
4. action planning within a strategic framework;
5. human resource development;
6. results and indicators;
7. review and feedback; and
8. stakeholder satisfaction

As such, RAPs for Great Lakes AOCs are perhaps the best example of community-based environmental protection in existence.¹⁸ Through the collaboration between public and private institutions, the RAPs apply a watershed approach to ecosystem regeneration and protection, as they progress toward the recovery of beneficial uses.

The experiment in collaboration aimed at aquatic ecosystem health, as Sproule-Jones asserts, provided an innovative approach in which resource users, regulators, and those with an interest in regenerating resilience for the local ecosystem can collaborate in service of a common purpose.¹⁹ They promise to empower local stakeholders to determine their own solutions to ecological degradation, and open new venues for collaboration.

With the assistance of governments, residents in most AOCs formed an advisory council/committee to work with federal/state/provincial technical and scientific experts. Citizen advisory committees were used as the focal point of public involvement for RAPs in 75 per cent of the AOCs. Known in various jurisdictions as public advisory committees, basin committees, or stakeholder groups, the IJC contends that such mechanisms are the key to implementing the ecosystem approach in RAPs. In citizen advisory committees, diverse interests come to the same table to participate in the planning process in an interactive manner, advising the planning agency throughout the preparation of the RAP. These committees

typically have or have had representatives from diverse community sectors, including agriculture, business, and industry, citizens-at-large, community groups, conservation and environment, education, fisheries, health, labour, municipal governments, Native peoples, shipping, tourism, and recreation.²⁰ Upon first examination, it is plausible that such diverse interests could result in opposing views, values, and priorities. The importance, however, of collaborative governance, as exemplified in successful RAPs, is elaborated on by Cheng and colleagues: “Collaborative governance of common-pool ecosystems and resources is expanding globally and is widely seen as contributing to the adaptive capacity of social-ecological systems. . . . Empirical research across ecosystem management contexts demonstrates how collaborative approaches can help in managing conflicts, building trust, pooling resources, building capacity, and sustaining action; collaboration is also shown to spark innovation, risk-taking, and more flexible, responsive actions because of the multiple viewpoints and resources that are leveraged through the collaborative process.”²¹

Engaging stakeholder groups in the plan design minimizes the risk of future polarization.²² Advisory committee participants possess unique knowledge and represent the interests of their particular stakeholder groups. A key premise is that community residents possess important knowledge, and can provide an informed perspective on the social impacts of the decisions.²³ The importance of involving communities in the management of water resources was one of the strongest and most consistent messages coming forward from an international conference in interjurisdictional water programs.²⁴ Also important is recognizing the value of traditional knowledge and the local public’s anecdotal and experiential intellect. Best practices in public engagement processes use plain language to communicate clearly, are supported by commitments in institutional programs and policies, demonstrate early and often how the public input will be used, include mechanisms to resolve disputes, provide the community with access to technical experts, and celebrate successes to nurture momentum and train community leaders, thereby building capacity to sustain progress.

Jetoo and colleagues note that governance can be difficult to define as it is used in a multitude of different ways.²⁵ While different interpretations abound, most agree that the basic characteristic of governance is

the migration of power from the central state up into supranational institutions, horizontally to non-state actors, and down to sub-national levels of government. Stakeholders have been instrumental in helping governments be more responsive to and responsible for restoring uses in AOCs. Further, stakeholders have been the primary catalyst for implementing actions that have resulted in ecosystem improvements. Such broad-based partnerships among diverse stakeholders can best be described as a step toward grassroots ecological democracy in the Great Lakes basin.²⁶ The collective objective is to work with governments and develop a plan to revitalize ecosystem health and implement the plan to achieve agreed-upon targets that indicate when beneficial uses are restored.²⁷

Central to the successful deployment of the RAP process is clear accountability for active interventions. This is best accomplished through the open sharing of information, clear and unambiguous definition of stressors and problems (including the identification of indicators to be used in measuring when the desired state for a beneficial use is reached), agreement on the priority actions required, and the identification of who is responsible for taking what action. From this foundation, Hartig and Zarull clearly delineate the responsible institutions and individuals that can be held accountable for progress.²⁵

Having been involved in RAPs since their inception, I can point to notable differences in the progress across the then (as of 1991) forty-three AOCs. The first stage for each RAP is to identify environmental problems, impaired beneficial uses, and their probable causes. This stage is for the most part complete. The second stage is to develop a recommended set of remedial actions and preventative initiatives to improve environmental quality in support of the beneficial uses. To develop focused and effective strategies to restore beneficial uses, targets need to be set by which RAP practitioners can recognize when they have met their goals surrounding beneficial uses. In some AOCs, the targets set science-based and quantitative targets whenever possible. In other cases, general statements guide the practitioners, making it difficult to recognize when success has been achieved. For example, rather than using ecosystem response indicators, selections may be based on restoration of a quantifiable measure of kilometres of riparian habitat remediated or installed. This measure does not necessarily correlate with what habitat in what quantities and

in which locations are necessary to support particular fish and wildlife, whose populations or communities may be degraded due to loss of habitat. Similarly, targets that are based on management actions completed (e.g., upgrading nutrient removal from waste-water treatment plants, or removing a particular volume of contaminated sediment) miss measuring the ecological outcome of the action (such as successful control of eutrophication, or restoration of healthy benthic populations).

The above represent significantly divergent approaches across the AOCs in the preparation of Stage 2 Plans (actions necessary to restore beneficial uses) and the degree to which their implementation will actually achieve the aim of restoring beneficial uses. There remains a dichotomy between those who perceive that completing the implementation of the actions is synonymous with the restoration of beneficial uses, and those who assert that the ecosystem will take time to respond to human intervention, and that a period of recovery may well be required for beneficial uses to be restored. The interpretation of the annex varies among and within jurisdictions, and the final decision to delist an AOC—that is, declare all beneficial uses restored—carries with it significant implications depending upon the local and jurisdictional definition of restoration.

Does restoration imply returning to original conditions? Does restoration mean the restoration of function? Further, there are clearly limits to restoration. An urban river will never have the structure and function of a river in an untouched watershed remote from anthropogenic pressures. While government guidelines inform “healthy” states, stakeholder values shape the policy consideration of what is an “acceptable” delisting target.

Stakeholders in various AOCs in the United States and Canada have made considerable investments of time and money, and several well-documented and highly visible successes can be pointed to.²⁸ Gurtner-Zimmermann notes that the commitment of individuals who participate in the RAP process, local support for the RAP goals, and the scientific basis and sound analysis of environmental issues contribute to the positive outcomes.²⁹ Major successes include Collingwood Harbour, Severn Sound, and Wheatley Harbour in Ontario, and Deer Lake, White Lakes, Presque Isle Bay, and Oswego River in the United States; in each of these locations conditions have improved to the point that they are no longer considered to be AOCs. Spanish Harbour and Jackfish Bay in Ontario are

FIGURE 12.5. Severn Sound case study.

Severn Sound was designated an AOC because a review of available data indicated that water quality and environmental health were severely degraded. In particular, eutrophication—as a result of sewage treatment plant (STP) inputs, agricultural activities, and shoreline development—was especially evident in the narrowing of the sound’s south shore.

What was accomplished?

The eutrophication impairment was addressed by controlling sources of phosphorus. Concentrations were addressed by reducing total phosphorus from STP discharges, upgrading private sewage systems, eliminating sewage bypasses and combined sewer overflows, and reducing inputs from agricultural sources.

The STP improvements reduced the phosphorus loads to meet RAP targets and provided considerable cost savings to the municipalities. Through the Sewage Treatment Optimization Project, the federal and provincial governments provided technical support and training for municipal operators in all 8 treatment plants in the AOC. In addition, the Ontario Ministry of the Environment and Climate Change contributed \$23 Million to upgrade 4 of the 8 STPs.

The Severn Sound Urban Stormwater Strategy was developed by municipalities, and enabling bylaws have been passed to govern new construction, stormwater retrofits and sewer separation projects. Farm-level projects managed manure runoff, treated direct milk house wastes, restricted livestock access to rivers and improved crop practices.

Through conservation agreements and wetland rehabilitation projects, 411 hectares of wetlands and their associated uplands have been protected to date. In streams flowing directly into Severn Sound, 132 projects have been completed, creating vegetation buffers and linking habitat nodes. In addition, natural heritage strategies are being adopted by townships and municipalities.

The economic viability of the area has improved through upgraded infrastructure, local job creation, and cost-effective decisions assisted by RAP studies. Volunteer participation and positive media support indicate that community acceptance of the RAP principles of maintaining a healthy environment, including ensuring economic and environmental sustainability, are built into municipal plans.

The delisting of Severn Sound was facilitated by the Severn Sound Environmental Association. The organization sought to provide community-based, cost-effective environmental management for the Severn Sound area, which sustained the improvements achieved through the RAP process.

Severn Sound was officially delisted in 2003.

now recognized as being in a stage of recovery due to completion of all selected remedial actions, while monitoring continues to measure recovery of beneficial uses.

The parties have completed all remedial actions at five other AOCs: Nipigon Bay in Canada; and Sheboygan River (Wisconsin), Waukegan Harbor (Illinois), Ashtabula River (Ohio), and St. Clair River (Michigan) in the United States. With remedial work completed, these five AOCs are now being monitored to determine when the Beneficial Use Impairments have been fully addressed and delisting can occur.³⁰ According to the *Progress Report of the Parties*, improvements in Canadian AOCs include the elimination of 65 impairments of beneficial uses of the environment, with 81 impairments remaining.³¹ In 2015, construction began on the largest contaminated sediment remediation project ever undertaken in a Canadian AOC. Through a public-private partnership, the project will clean up 700,000 cubic metres of severely contaminated sediment in the Hamilton Harbour AOC. Other accomplishments in Canadian AOCs during the 2013–16 period include improvements to approximately 4 kilometres of shoreline habitat and approximately 180 hectares of coastal wetlands and fish spawning grounds, and investments of approximately \$562 million in upgrades to municipal waste-water treatment plants to significantly reduce nutrients, suspended solids, and pollutants.

In the United States, 62 impairments of beneficial uses of the environment have been removed, with 193 impairments remaining. The US Environmental Protection Agency estimates that management actions will be completed at 9 more AOCs by 2019. This pace of AOC restoration is attributed to the Great Lakes Restoration Initiative, by which federal agencies have been able to apply over \$650 million in Great Lakes Restoration Initiative funding to finance RAP implementation.

Figures 12.3, 12.4, and 12.5 provide case studies in RAP achievements and successes. We can celebrate these strides forward; however, human health is still being compromised by toxic chemicals, particularly for those consuming fish that are contaminated at unsafe levels, and particularly for children exposed to contaminants in utero.³² More aggressive action to revitalize the lakes is essential to protect the health of all their residents. The chemical, physical, and biological integrity of the Great

Lakes basin ecosystem remains threatened. It is apparent that a lack of resources and lack of inter-program coordination and co-operation still impedes progress.

Beierle and Koniski note other challenges to progress.³³ In their analysis, most stakeholder advisory committees in the RAP cases they studied did not engage the wider public in the decision-making process, and lacked socio-economically representative membership. Further, the ability of stakeholder involvement to improving environmental quality through coordinated action was unclear, as the process broke down in the implementation phase.

Environmental indicators communicate information about the environment and about the human activities that affect it. When communicated effectively, the indicator highlights problems and draws attention to the effectiveness of current policies. The target audiences are the public and the decision-makers (i.e., governments). To command their attention, indicators must be relevant, and they must communicate value. Choosing an indicator reflects a set of values that is perceived as being important.³⁴ The IJC's Indicators for Evaluation Task Force recommended indicators to evaluate progress under the Great Lakes Water Quality Agreement.³⁵ As a major initiative in fulfilling their reporting responsibility, the parties (the governments of Canada and the United States) developed a State of the Great Lakes Ecosystem reporting system. The State of the Great Lakes Ecosystem Conference (SOLEC) reports provide a framework for a broad assessment of the state of the Great Lakes. The first conference was held in October 1994.

Clearly, the basic water policy goals of swimmable, fishable, drinkable water, which emerged from SOLEC and the IJC recommendations, remain elusive in many Great Lakes communities.³⁶ To make matters more complicated, the IJC faces serious challenges as a transboundary institution with oversight on a non-binding international agreement. As Johns points out: "No politicians or governments in the US or Canada face serious political fallout if the commitments are not achieved or ignored."³⁷

Despite stated co-operative objectives on the part of the parties, the RAP strategy exhibits problems in the implementation phase, particularly as a result of a lack of enforcement authority.³⁸ So while the IJC does advise the parties in developing RAPs, its advice lacks meaningful enforcement

authority. A lack of accountability and responsibility among the parties and state and provincial agencies also presents significant barriers to RAP implementation. Langston asserts that despite the IJC's biennial reports (now triennial since the 2012 GLWQA protocol) to the parties that highlight lack of progress on virtual elimination of persistent toxic substances, governments continue to lag in effective action, and are purportedly using RAP development efforts as an excuse to delay implementation and action.³⁹

Margerum and Robinson advise that partnerships operating at the organizational level require networks that support the flow of information and decisions across agencies. While such efforts predict improved decision-making, long-term efficiencies, and better outcomes, there are high transaction costs and the benefits often accrue only over the long term.⁴⁰ They point out that this necessitates that leaders be willing to make long-term investments and that organizations understand the need to change their culture and reward structures to support partnerships. For RAPs this is a difficult challenge if current pressures were aimed at short-term results, individual performance measures, and a focus on core organizational goals rather than collective management to attain shared goals.

Hall and colleagues provide an evaluation of the strengths of the RAP processes. To achieve the goal of restoring environmental health and qualities to the Hamilton Harbour AOC, an embayment at the western end of Lake Ontario, requires

a dynamic process that relies heavily on research and monitoring to direct remediation efforts. Three principle means of coordinating this research and monitoring include: research and monitoring workshops; a monitoring catalogue outlining both government and nongovernment initiatives; and an annual report written by a local community group. These tools increase the effectiveness of remedial actions by: (i) improving stakeholders' ability to track trends; (ii) allowing program decision-makers to utilize adaptive management techniques to continuously modify programs based on new results; (iii) integrating interdisciplinary fields, and (iv) increasing accountability.⁴¹

The 2006–7 Review of the 1987 GLWQA

The IJC's Advice To Governments On Their Review Of The Great Lakes Water Quality Agreement states that "Article VII, a permanent reference under Article IX of the Boundary Waters Treaty, requires that the International Joint Commission . . . among other things, issue a biennial report concerning progress by the Parties and the state and provincial governments toward achieving the Agreement's general and specific purposes."⁴² Article x requires that the parties conduct a comprehensive review of the agreement's operation and effectiveness following every third such biennial report. The IJC's *12th Biennial Report*, issued in September 2004, triggered the requirement for the review that took place in 2006 and concluded in 2007.

The reviewers, comprised of agency and non-agency staff and individuals, concluded that Annex II's stated purpose was ambiguous. Improved clarity was called for in several instances. The Agreement Review Committee drew attention to the following:

- There is ambiguity regarding whether the Annex takes an ecosystem approach or simply a water quality approach.
- There is ambiguity regarding whether the Annex focus is on the open waters only or on nearshore, inland, tributaries, and watersheds.
- Beneficial Use Impairments are poorly defined, particularly with regard to human health.
- There is a general question about the purpose of the Annex regarding whether it uses an ecosystem approach or a water quality approach.
- There is a question related to whether the Remedial Action Plans and Lakewide Management Plans are to be prepared and implemented in relation to Critical Pollutants using an ecosystem approach to the multi-media sources, pathways and distribution of this narrow group of contaminants or are they for general ecosystem management and stewardship within the Great Lakes basin?⁴³

The IJC binationally canvassed citizens of the basin to gain feedback on perceived successes and deficits associated with the implementation of the GLWQA.⁴⁴ Perhaps not surprisingly, RAPs, having strong public engagement attributes, drew the most responses, and RAPs were repeatedly used as examples of shortcomings in GLWQA implementation:

“They were probably the source of greatest hope for visible, tangible Improvement on an AOC-by-AOC level,” said one retired government official who is still active in environmental issues. Many questions were raised in connection with Remedial Action Plans (RAPs). “Is the concept of RAPs fundamentally flawed?” asked one participant. “Did we not invest enough money? Were they not high priority enough? Did they not fit with other programs? Did we not manage them effectively enough? Were the local government people not involved enough?” Overall, insufficient funding, bureaucratization, inadequate or ineffective public participation, and a lack of accountability provisions were the factors most often cited.⁴⁵

Annex 1 of the 2012 GLWQA

Almost everyone who has been involved in the RAP process has learned a lot over the past three decades. There emerged a school of thought that, under some conditions, following the full implementation of all practical remedial measures, nature may be the best source of recovery and restoration. The parties should consider recognizing “Areas of Concern in Recovery” as an interim step to delisting at sites where remedial measures have been implemented, yet the ecosystem is still recovering. Since Annex 1 now stipulates that the final step in RAPs prior to delisting is the achievement of the restoration of beneficial uses, recognizing AOCs in Recovery signals an enormous milestone in the advancement to the stage of delisting. Ongoing monitoring of the recovery is a necessary component of this designation. It is an interim designation that takes into account the difficulty in determining the limits to restoration, because there is no

way of knowing the unforeseeable advances in technology, availability of resources, or public will.

Coming into effect in 2013, the 2012 GLWQA protocol adjusted the 1987 Annex 2 into the new Annex 1. According to the agreement: “For each AOC, the Parties, in cooperation and consultation with State and Provincial Governments, Tribal Governments, First Nations, Métis, Municipal Governments, watershed management agencies, other local public agencies, and the Public, shall develop and implement a systematic and comprehensive ecosystem approach to restoring beneficial use.”⁴⁶ Also new to the RAP process is the allowance that “a Party may elect to identify an AOC as an AOC in Recovery when all remedial actions identified in the RAP have been implemented and monitoring confirms that recovery is progressing in accordance with the RAP. A Party shall monitor and take further action, if required, to restore beneficial uses within an AOC in Recovery.”

Annex 1 of the 2012 agreement makes reference to the IJC three times:

The Agreement requires that the governments of the US and Canada:

1. Consult with IJC to designate additional AOCs based on an evaluation of BUIs
2. Make RAPs available to the IJC
3. Solicit a review and comments from the IJC prior to the designation of an AOC in Recovery and prior to the removal of a designation as an AOC or an AOC in Recovery.⁴⁴

The IJC is expected to provide time-sensitive comments on RAP reports, particularly as they relate to delisting and/or designation of AOCs in Recovery. The IJC is also expected to ensure that their feedback reflects state-of-the-art science as well as public input. Figure 12.2 illustrated the process for IJC review of RAP delisting reports. What remains unclear is the value added by IJC comments, given that the decision to delist remains that of the parties.

Conclusion

The IJC's reputation for impartiality can be attributed to the tradition of the six commissioners seeking consensus and rarely splitting along national lines. The commissioners do not act under instruction from or as representatives of their governments, but on behalf of the binational resource. That said, as political appointees of their own countries, they naturally carry national or party philosophies and may clash along national lines. Lemarquand emphasizes that, notwithstanding this situation, they are free from government control and meet as one body, which encourages a collegial approach to problem-solving, as opposed to the negotiation approach characteristic of commissioners acting as agents of their governments.⁴⁷ Success, asserts Lemarquand, depends on the appointment of qualified, capable, and politically perceptive commissioners. Over the years the governments have had a decidedly mixed record in appointing commissioners with those qualities, and these governments must take much of the responsibility during periods where the performance of the IJC has been somewhat inconsequential.

A major challenge for the IJC and the GLWQA is the process of bringing together a diverse cross-section of society in a neutral setting to address environmental, political, and/or societal issues in a manner that is very difficult to achieve within jurisdictional limitations, policy, or geopolitics. The committee structure under the Water Quality Board and the Science Advisory Board enables this to happen. Complex issues are addressed with members acting in their personal and professional capacity, not at the instruction of their agency. The IJC structure can successfully circumvent necessary but often cumbersome government bureaucracy, and the involvement of those holding the knowledge and expertise allows for objective, feasible, and important recommendations for action.

Annex 1 under the 2012 protocol is perhaps the most public of the GLWQA's annexes, because the activities required therein depended on the extensive involvement of interest groups and Great Lakes stakeholders. Newig and Fritsch make the point that multi-level governance has components that include "political structures and processes that go beyond the bounds of administrative jurisdictions, with the purpose of accounting for the interdependencies in societal development and political

decision making which exist among geopolitical units. Systems of governance at different levels are ideally not hierarchical in a command and control sense, but rather are a blend of formally independent, yet mutually interacting governance levels.⁴⁸

Where successful, RAPs clearly embrace the ecosystem approach. Here, the ecosystem approach is based on the man-in-system concept rather than a system-external-to-man concept,⁴⁹ where the ecosystem is composed of the interacting elements of water, air, land, and living organisms, including man. While Lee and colleagues discuss several variants of the ecosystem approach, most share a focus on the responsiveness of ecological systems to natural and human activities, and a readiness to strike a programmatic compromise between detailed understanding and more comprehensive holistic meaning. This flexible, pragmatic approach is perhaps the most productive feature for addressing Great Lakes environmental problems. Now that the parties have renegotiated a revised GLWQA it is imperative that they learn from the past: what has worked, what has not worked, and why. This would inform more successful outcomes regarding the implementation of Annex 1 and help instruct the governance mechanisms for addressing the nearshore zones in a local and regional manner under the new Annex 2.

Hartig and Law concluded that RAPs (and here one could substitute any place-based approach to ecosystem restoration) require co-operative learning that involves stakeholders working in teams to accomplish a common goal under conditions that involve positive interdependence (all stakeholders co-operate to complete a task) and individual and group accountability (each stakeholder is accountable for the final outcome).⁵⁰ Place-based types of restoration initiatives like RAPs are an unprecedented collaboration of international significance.⁵¹ Creative, distributed governance mechanisms and new institutional arrangements are needed to stimulate and sustain advances in the clean-up of local waterways, raise public awareness of individuals' responsibilities, unite a community around a shared purpose and need, and make the lakes Great.⁵²

Notes

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