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STUDY ON GREAT LAKES WATER QUALITY

Report of the Standing Committee on Environment and Sustainable Development

Harold Albrecht
Chair

JUNE 2014

41st PARLIAMENT, SECOND SESSION

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THE STANDING COMMITTEE ON ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

has the honour to present its

THIRD REPORT

Pursuant to its mandate under Standing Order 108(2), the Committee has studied the water quality of the Great Lakes Basin and has agreed to report the following:

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STUDY ON GREAT LAKES WATER QUALITY

INTRODUCTION

In June 1969, the Cuyahoga River, slicked with oil, caught fire, again.[1] The Cuyahoga River flows into Lake Erie, which, around the same time as the Cuyahoga caught fire, was experiencing major algal blooms resulting from excessive amounts of phosphorus in the water. The result was dead areas at the bottom of the lake as well as spoiled nearshore areas. A "pervasive plague of toxic chemicals contaminating fish, water and sediment"[2] added to the lake's problems. These environmental issues were not confined to Lake Erie. Problems with over-enrichment from phosphorus and toxic chemicals existed across the Great Lakes.[3]

The Canadian and United States governments responded to this crisis by negotiating the *Great Lakes Water Quality Agreement*, which the two countries signed in 1972. "The scope was broad and it was based in large part on our scientific efforts. The need for a major cleanup was obvious, and the two countries, Canada and the U.S.A., Ontario, and eight states made clear commitments to pollution control programs in the agreement and in the related Canada-Ontario agreement."[4]

After the agreement was signed, all levels of government in both countries tackled the Great Lakes' problems vigorously. Sewage treatment plants for municipalities and industries were built. Phosphorus in detergents was regulated. Farmers adopted conservation tillage practices, and PCBs and DDT[5] were banned in both countries. "This effort had wonderful effects, and by the late 1980s the main body of the lakes was pronounced healthy again."[6] In 2012, the Government of Canada reaffirmed its commitment to the remediation of the Great Lakes and signed an amended *Great Lakes*

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1 This event was mentioned by a representative from the International Joint Commission who appeared before the Committee to testify on the Water Quality of the Great Lakes Basin study. See House of Commons, Standing Committee on Environment and Sustainable Development [ENVI], *Evidence*, 25 February 2014 (Gordon W. Walker, Acting Chair, Canadian Section, International Joint Commission). For details see: Michael Rotman, "Cuyahoga Fire," *Cleveland Historical*.

2 ENVI, *Evidence*, 27 March 2014 (James Bruce, Representative, Forum for Leadership on Water).

3 Ibid. Lake Superior probably did not experience the same nearshore problems and dead areas due to phosphorus inputs that the other lakes did.

4 ENVI, *Evidence*, 27 March 2014 (James Bruce).

5 PCB stands for polychlorinated biphenyls. DDT stands for dichlorodiphenyltrichloroethane. Both are toxic chemicals that were in the original "dirty dozen" chemicals addressed by the 2001 *Stockholm Convention on Persistent Organic Pollutants*.

6 ENVI, *Evidence*, 27 March 2014 (James Bruce).

Water Quality Agreement, which is "considered to be one of the most enduring and successful environmental agreements in the world."[7]

Although great success had been attributed to the remediation efforts of the past, witnesses have highlighted some new challenges. In 2011, an "infamous algal bloom … started in the western basin of Lake Erie and gradually spread and covered a good part of the lake."[8] "Algal blooms on Lake Erie, especially blue-green algae …, are now seen as worse than before the big clean-up that began in 1972. … For highly toxic mercury, after reductions from 1970 to 2005, we now see concentrations on the rise again in some fish and fish-eating birds, such as loons. … [And] a host of new contaminants, not removed at conventional sewage treatment plants, [are] finding their way to the lakes. These contaminants include dumped or excreted pharmaceuticals. There are small but growing concentrations of anti-inflammatory drugs in Lake Erie's open water, far from shore. Antidepressants have been found in Lake Ontario and antibiotics in the St. Lawrence River. Endocrine-disrupting substances have been found in Lake Huron."[9]

Recognizing the immense economic, environmental and social importance of clean Great Lakes to the 30% of Canada's population that lives within the Great Lakes Basin,[10] the House of Commons Standing Committee on Environment and Sustainable Development (the Committee) undertook a study on the water quality of the Great Lakes Basin. On 10 December 2013, the Committee agreed to the following motion:

> That the committee undertake a ten (10) meeting study on the Water quality of the Great Lakes Basin. This study will focus on three (3) areas: (a) identifying locations within the Great Lakes Basin that are of environmental concern and the prioritization of these areas to be addressed; (b) reviewing the efforts that are planned and/or currently underway to remediate the identifiable areas of environmental concern; and (c) recommending best practices that will facilitate the further remediation of areas of environmental concern within the Great Lakes Basin.[11]

The Committee heard from 31 witnesses over the course of 9 meetings from February to April of 2014 and is now pleased to present this report and recommendations to the Government of Canada on Water Quality of the Great Lakes Basin.

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7 ENVI, *Evidence*, 25 February 2014 (Gordon Walker).

8 Ibid. (William Taylor, Professor Emeritus, Biology, University of Waterloo).

9 Ibid. (James Bruce).

10 ENVI, *Evidence*, 25 February 2014 (Robert Lambe, Executive Secretary, Great Lakes Fishery Commission).

11 ENVI, *Minutes of Proceedings*, 10 December 2013.

Water Quality and the Great Lakes Basin

Witnesses stressed the importance of water quality in the Great Lakes Basin to Ontario and to Canada as a whole. According to a representative from the provincial government, 80% of Ontarians obtain their drinking water from the Great Lakes.[12] "The Great Lakes Basin is home to 98% of Ontarians"[13] and contains over 90% of Ontario's agricultural land, accounting "for the largest share of the total Canadian GDP in agriculture and food processing, 33.2%, to be exact."[14] Great Lakes fisheries, including spinoffs, are worth an estimated $8.3 billion.[15]

Clearly, the water in the Great Lakes is essential to millions of people; its preservation is therefore a key priority of the Government of Canada. Historic toxic sediment deposits in the lakes, along with ongoing excessive inputs of phosphorus and new toxic substances represent some of the new challenges. A resurgence of algal blooms alone threatens to increase water treatment costs, degrade ecosystems for fish and wildlife, and have adverse impacts on tourism and fisheries.[16]

One witness referred to a study which suggested that an investment of $26 billion in remediation efforts along the United States Great Lakes shore could yield $50 billion in long-term regional benefits and between $30 billion and $50 billion in short-term benefits.[17] Remediation of water quality should therefore be seen as an investment with potentially high returns. This is particularly true for geographical locations with significant water quality impairment.

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12 ENVI, *Evidence*, 4 March 2014 (Maurice Bitran, Assistant Deputy Minister, Ministry of the Environment, Integrated Environmental Policy Division, Government of Ontario).

13 Ibid. (Jim Richardson, Director, Ministry of Agriculture & Food, Environmental Management Branch, Government of Ontario).

14 Ibid.

15 ENVI, *Evidence*, 13 February 2014 (David Burden, Acting Regional Director General, Fisheries and Oceans Canada).

16 Ibid. (Chris Forbes, Assistant Deputy Minister, Strategic Policy Branch and Regional Directors General Offices, Environment Canada).

17 ENVI, *Evidence*, 3 April 2014 (Robert Florean, Council Member and Technical Advisor, Manitoulin Area Stewardship Council) citing John Austin *et al.*, *America's North Coast: A Benefit-Cost Analysis of a Program to Protect and Restore the Great Lakes*, September 2007.

LOCATIONS OF ENVIRONMENTAL CONCERN AND REMEDIATION EFFORTS

The first two parts of the Committee's study involved identifying locations of environmental concern within the Great Lakes Basin and reviewing related remediation efforts that are either planned or underway. The Committee is aware that specific pollution hotspots, known as "areas of concern," have already been identified under the *Great Lakes Water Quality Agreement.* The Committee heard from witnesses regarding several of these areas of concern as well as from witnesses concerned about some other locations of environmental concern within the Great Lakes Basin. For all these locations, the environmental concerns and remediation efforts described by witnesses are summarized below.

Areas of Concern

Under the 1987 version of the *Great Lakes Water Quality Agreement,* 43 pollution hotspots within the Great Lakes were designated "areas of concern." Twelve areas of concern are in Canada, and another five straddle the border and are therefore termed "binational" areas of concern. All of these areas were designated on the basis that "significant impairment of beneficial uses has occurred as a result of human activities at the local level."[18] The degree of water quality degradation was measured using a list of 14 possible "beneficial use impairments." For example, impairments such as "restrictions on fish and wildlife consumption" and "beach closings" are included on the list.[19]

For each area of concern, a remedial action plan has been developed (two plans for binational areas) to guide the restoration of beneficial uses, taking into account local conditions. In practice, remedial action plans are "carried out by dozens of organizations, including federal, … provincial and local governments and volunteer groups and businesses, among others. Funding mechanisms are equally complex."[20] As the Committee was informed, "once the remedial action plans were developed, each of these areas of concern developed restoration councils, which involved a number of federal and provincial agencies, but also involved members of the community from the first nations, industry, municipalities, conservation authorities, non-profits, and other members of the public."[21]

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18 Environment Canada, "Annex 1 – Areas of Concern", *Great Lakes Water Quality Agreement*.

19 Ibid.

20 International Joint Commission, "Background", *Status of Restoration Activities in Great Lakes Areas of Concern*, April 2003.

21 ENVI, *Evidence*, 27 March 2014 (Jeff Ridal, Executive Director, St. Lawrence River Institute of Environmental Sciences).

An area of concern is "delisted" when "environmental monitoring confirms that beneficial uses have been restored in accordance with the criteria established in the [remedial action plan]."[22] To date, five areas of concern have been delisted: three in Canada and two in the United States. Two additional Canadian areas of concern are classified as "in recovery" on the basis of all remedial actions having been completed, but more time is needed for the environment to recover sufficiently for the area to be delisted. In addition, many beneficial uses have been restored at other areas of concern that have not yet been fully remediated.

The Committee heard from a number of organizations involved in remedial action plans and restoration of three of Canada's remaining areas of concern as well as several binational areas of concern.

A. Hamilton Harbour

Prior to the designation of areas of concern under the *Great Lakes Water Quality Agreement*, Hamilton Harbour had already been identified as a "pollution hotspot."[23] In fact, historically it had been deemed the most polluted of all the Canadian hotspots.[24] The pollution in Hamilton Harbour is largely the legacy of steel and iron industries, which dominated the harbour, although the region remains 50% agricultural.[25] In addition, pollution has been caused by three wastewater plants that discharge into the harbour. The resultant coal tar deposits and raw sewage have severely degraded the water quality in the harbour and impaired associated ecosystem functions.[26] Regulated high water levels have also damaged wetlands in the harbour.[27]

The remedial action plan for Hamilton Harbour was developed by a stakeholder group of more than 40 organizations representing industry, governments and citizens of the region. It has been implemented by a group of 18 stakeholders known as the Bay Area Implementation Team, which is co-chaired by Environment Canada and the Ontario Ministry of the Environment. The public has a significant role in the harbour's remediation through a second organization, the Bay Area Restoration Council. It was acknowledged that over the past 30 years, a considerable amount of work has been undertaken and,

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22 Environment Canada, "Annex 1 – Areas of Concern", *Great Lakes Water Quality Agreement*.

23 ENVI, *Evidence*, 27 February 2014 (Chris Murray, City Manager, City of Hamilton).

24 Ibid.

25 Ibid.

26 For a detailed list of the beneficial use impairments and an update on their status as of 2010, see Governments of Ontario and Canada, *Hamilton Harbour Area of Concern Status of Beneficial Use Impairments September 2010*.

27 ENVI, *Evidence*, 27 March 2014 (Patricia Chow-Fraser, Professor, Director of Life Sciences Program, McMaster University, Department of Biology, as an Individual).

thanks to the support of the federal government, Hamilton Harbour will likely begin the delisting process by 2020.[28]

In addition to providing funding for clean-up efforts, Environment Canada staff at the Canada Centre for Inland Waters research facility, located on the harbour, have played an "essential"[29] role in developing the remedial action plan for Hamilton Harbour, providing scientific expertise and working with other levels of government and community stakeholders to develop the remedial action plan.[30]

While many small projects have been undertaken, a fundamental priority has been to upgrade wastewater facilities that discharge into the harbour. Between 1990 and 2010, about $1.2 billion was invested in remediation efforts, $800 million of which has funded upgrades to wastewater facilities to provide for tertiary treatment. Industry contributed approximately 80% of the total amount spent to date, with the remainder coming from the Ontario and federal governments.

The other priority for the harbour is to remediate Randle Reef, a coal tar deposit within the harbour equivalent in size to the deposit of the Sydney Tar Ponds in Cape Breton.[31] Work to contain the Randle Reef sediment is to start next year and will take approximately 10 years to complete at a cost of about $140 million, to be split equally among the Ontario and federal governments and the community.[32]

Phosphorus also remains a problem in Hamilton Harbour. Although phosphorus inputs to the harbour have been reduced by half as a result of the wastewater treatment upgrades, phosphorus continues to enter the harbour from rain and melted snow runoff from the agricultural and urban landscape, necessitating a further 50% reduction in phosphorus entering the watershed.[33] Pollution entering the Great Lakes from such diffuse locations and origins is termed "non-point source" pollution. Now that phosphorus inputs from the wastewater treatment plants are being addressed through infrastructure upgrades, efforts are being refocused to address non-point source phosphorus pollution into Hamilton Harbour.[34]

Through such large-scale projects to improve water quality in the harbour and a "record of many small victories,"[35] the goal is to delist Hamilton Harbour as an area of

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28 ENVI, *Evidence*, 27 February 2014 (Chris Murray).

29 Ibid. (John Hall, Coordinator, Hamilton Harbour Remedial Action Plan, City of Hamilton).

30 Ibid.

31 ENVI, *Evidence*, 27 February 2014 (Chris Murray).

32 Ibid.

33 Ibid. (John Hall).

34 Ibid.

35 ENVI, *Evidence*, 8 April 2014 (Chris McLaughlin, Executive Director, Bay Area Restoration Council).

concern by about 2020.[36] However, tackling non-point sources of pollution in the Hamilton region will be essential to meeting this goal and ultimately, delisting will depend on how the environment responds to all these efforts.

B. Toronto and Region

The Toronto and Region area of concern encompasses six watersheds from the Rouge River in the east to Etobicoke Creek in the west. It includes 42 km of waterfront, 11 municipal jurisdictions, and over 4 million residents.[37]

Population growth and urbanization, in combination with wet weather events, contribute to water quality issues in the Toronto region.[38] From the late 1800s to about 1950, drainage systems were built to carry both sewage and storm water in a single pipe. During heavy rains, the volume of water overwhelms the system in what is known as a combined sewer overflow. The result is that a mix of raw sewage and rain water is discharged through 34 outfalls into Lake Ontario, and through another 46 outfalls to streams and rivers throughout the city. New sewers built since about 1950, however, have separate storm and sanitary pipes.[39]

The Committee heard that the water quality of stormwater and combined sewer overflows is surprisingly similar, except for some differences in nutrient and bacterial counts. Combined sewer overflows and direct stormwater runoff both have three to four orders of magnitude higher *E. coli* counts than the provincial water quality objective for beaches designated for swimming. The replacement of combined sewer systems with separate sewers for storm water and sewage will therefore not be sufficient to protect beaches. A massive infrastructure upgrade is required to manage stormwater.[40]

Toronto has responded by developing the Wet Weather Flow Master Plan. The plan includes: mandatory disconnection of downspouts from the sewer system; maintenance of current roadside ditches; installation of leaky pipe systems;[41] identification of 170 opportunities for green facilities or stormwater ponds or wetland areas; and where space is limited, underground water storage systems, tanks and tunnels.

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36 ENVI, *Evidence*, 27 February 2014 (Chris Murray).

37 Toronto and Region Remedial Action Plan, *Background*.

38 Toronto and Region Remedial Action Plan, *Issues*. Also see "Chapter 2 – Existing Conditions", *Toronto and Region Remedial Action Plan, Moving Forward, Progress Report 2007*, 2009.

39 ENVI, *Evidence*, 27 February 2014 (Michael D'Andrea, Executive Director, Engineering and Construction Services, City of Toronto).

40 Ibid.

41 Leaky pipe systems, also known as perforated pipe systems, "typically consist of perforated pipes embedded in stone-filled trenches installed within the road right-of-way or along the rear yard lot line. Stormwater is directed to the perforated pipe through catchbasins and runoff is captured and stored in the trench where it is allowed to infiltrate into the surrounding soils. Runoff in excess of the soil infiltration capacity is routed to the storm sewer." Sustainable Technologies Evaluation Program, *Perforated Pipe Systems*.

An expert witness representing the city stressed the need for sewer infrastructure by recounting the events of a storm that occurred in August 2005 during which 150 mm of rain fell in 3 hours. He expressed support for green infrastructure, but explained that it could only "intercept maybe 5 mm to 10 mm of rainfall… so you need much more than green."[42] Because major storms are occurring more frequently, Toronto's leadership is of the view that it is incumbent upon them "to do something about it."[43]

Part of the Wet Weather Flow Master Plan is the most significant project intended to help delist the Toronto region as an area of concern. A 23 km-long tunnel is to be built along the Don River and central waterfront, including 15 underground storage shafts measuring 30 metres in diameter and 50 metres deep. Eventually, the system will be hooked up to a high-speed treatment plant being tested in partnership with Environment Canada.[44]

Implementing the Wet Weather Flow Master Plan is truly a massive, expensive and disruptive undertaking. Neighbourhoods "look like war zones"[45] as streets are ripped up to put in place the underground storage. All told, the project will take 25 years to construct and cost $1.5 billion, to be paid with revenues generated by the City of Toronto over that time frame through the sale of water.[46]

C. Bay of Quinte

The Bay of Quinte is a shallow, 100 km-long bay on the north-eastern shore of Lake Ontario. The bay is separated from Lake Ontario by Prince Edward County and Amherst Island. Three major watersheds drain into the bay via the Trent, Moira and Napanee Rivers.[47] The bay was identified as an area of concern because of water quality impairments caused by excess nutrients, persistent toxic contamination, bacterial pollution and the loss or destruction of fish and wildlife habitat.[48]

The Committee heard from a representative from Quinte Conservation, one of the two conservation authorities responsible for watershed management in the Bay of Quinte, who discussed two of the bay's principal issues: arsenic contamination and nutrient loads.

Arsenic contamination is a legacy of the Deloro Mine, which began as a gold mine in 1866 and was transformed into a cobalt smelter after 1901. Mining and smelter

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42 ENVI, *Evidence*, 27 February 2014 (Michael D'Andrea).

43 Ibid.

44 Ibid.

45 Ibid.

46 Ibid.

47 Bay of Quinte Remedial Action Plan Coordinating Committee, *Bay of Quinte Remedial Action Plan, Stage 1, Environmental Setting and Problem Definition*, July 1990.

48 Bay of Quinte, "The Area of Concern", *Remedial Action Plan*,

operations involved removing arsenic from the ore, and the site became heavily contaminated. Arsenic was transported to the Bay of Quinte via the Moira River, which runs through the site.[49]

As one witness explained, thousands of tonnes of arsenic made it downriver to the Bay of Quinte because of "years of not knowing what people were doing when we were dumping pollution into the rivers draining directly into the bay."[50] Arsenic loading into the Moira River has been stopped through filtration, and arsenic at the old mine site is being contained. The arsenic that polluted the bay is now contained within the sediment, and dredging is banned in order that the sediment not be disturbed.

Of the initial 80 concerns requiring action in the bay, 50 have been addressed. The remaining 30 concerns are all related to phosphorus levels. As the Committee heard, if phosphorus levels can be contained, the rest of the problems can be controlled, and the Bay of Quinte area of concern can be delisted.[51]

Approximately $20 million has been spent to "protect wetlands, to restore shorelines, to put in alternate watering holes for cattle, and for manure storage and that type of thing, to prevent runoff into the creeks and to try to control the phosphorus problems."[52] Half of that $20 million was provided through government funding to Quinte Conservation, and the other half came from private industry and the agricultural community. The agricultural community in particular was noted for spending millions of dollars to create buffer zones to control runoff, even in the absence of incentive programs.

Despite these efforts, more research and action is required. Quinte Conservation "does have the expertise, but [not] the financial capability for doing all the work that's required."[53] Nonetheless, the goal is to complete remedial activities for the Bay of Quinte area of concern by 2017, with delisting occurring several years later depending on how long it takes for the environment to recover.[54]

D. St. Lawrence River

The St. Lawrence River is a binational area of concern that has been divided into two parts: the Cornwall area of concern in Canada and the Massena area of concern in the United States. Separate remedial action plans have been developed to address each part. The Cornwall area of concern is approximately 80 km long, extending from the

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49 William Draper et al., "Cultural Heritage Evaluation Report, Deloro Mine Site Township of Marmora and Lake County of Hastings, Ontario", *Final Report to the Ontario Ministry of the Environment*, 20 April 2012.

50 ENVI, *Evidence*, 25 March 2014 (Terry Murphy, General Manager and Secretary Treasurer, Quinte Conservation Authority).

51 Ibid.

52 Ibid.

53 Ibid.

54 ENVI, *Evidence*, 27 March 2014 (Jeff Ridal).

Moses-Saunders power dam to the eastern outlet of Lake St. Francis.[55] Remediation of this area of concern is significantly different than in other areas, not only due to its international aspect, but also because it crosses the Ontario–Quebec provincial border and because the Akwesasne Mohawk First Nation is significantly involved.

Like many of the other areas of concern, the St. Lawrence River area of concern is the legacy of historic, long-term industrial activity. In this case, primary pollutants in the area are mercury and PCBs. Continued contamination to the area comes from industrial and municipal effluent, non-point sources such as urban storm water and agricultural runoff and air deposition. Being downstream of all the Great Lakes, the St. Lawrence River area of concern is also the recipient of pollution from across the system, via Lake Ontario. In addition, land-use practices, shipping and the extensive shoreline and water flow alterations made during the construction of the St. Lawrence Seaway have altered the natural features of the area.[56]

Similar to the Hamilton Harbour remedial action plan, a group has been formed to act as a liaison between the remedial action plan implementing council and the public. This group is led by the St. Lawrence River Institute of Environmental Sciences, a unique organization that grew from the public process during the early years after the area of concern was designated. The Institute is based on a partnership of the local municipalities, the Mohawks of Akwesasne and leading citizens. It undertakes research "to provide expertise for the local scientists in an area of concern like Cornwall."[57] Experience the Institute gains is shared with other areas of concern, notably the Bay of Quinte.[58] The institute has its own facility, built exclusively with local funding on land provided free by the local college. The genesis and accomplishments of the Institute are a source of pride within the local community.

Considerable progress has been made in remediating the St. Lawrence area of concern.[59] Industrial and municipal discharges have been abated, including through sewage treatment plant upgrades. Habitat is being restored and municipalities have developed long-term anti-pollution plans. As of 2010, there were three remaining beneficial

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55 Raisin Region Conservation Authority, *St. Lawrence River (Cornwall) Area of Concern*.

56 Government of Ontario and Government of Canada, *St. Lawrence River Area of Concern – Canadian Section – Status of Beneficial Use Impairments*, September 2010.

57 ENVI, *Evidence*, 27 March 2014 (Jeff Ridal).

58 Ibid.

59 Ibid.

use impairments in the area: eutrophication or undesirable algae,[60] loss of fish habitat and restrictions on fish consumption.[61] These impairments are of particular concern to the Mohawk Council of Akwesasne, which stated that "no substantive studies have been undertaken to verify that the contaminant levels in the fish, sediments, and plants in and along the river would support the delisting of the St. Lawrence River area of concern."[62]

Phosphorus inputs to the river from agricultural sources continue to pose a problem. Accordingly, best management practices need to be implemented to control erosion, improve septic systems, contain manure effectively and generally address non-point source phosphorus pollution. [63]

E. Other Binational Areas of Concern

The St. Lawrence River is one of five binational areas of concern. Three other binational areas of concern discussed during the Committee's study — St. Marys River, St. Clair River and Detroit River — were noted for having the "most impairment."[64] Another witness described these areas of concern as having "very challenging contaminated sediment problems."[65]

The St. Marys River, which joins Lake Superior with Lake Huron, is contaminated with oil from steel manufacturing. The St. Clair River, which is the primary outflow from Lake Huron toward Lake Erie via Lake St. Clair, is contaminated from 27 industrial facilities, including petrochemical plants, in Sarnia, Ontario, and 6 in the United States.[66] The Detroit River starts at Lake St. Clair and finishes the connection from Lake Huron to Lake Erie. Seventy-six industries and 10 municipalities discharge wastewater into the Detroit River watershed. Combined sewer overflows, sanitary sewer overflows and

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60 "Eutrophication or undesirable algae" occurs "[w]hen there are persistent water quality problems (e.g., dissolved oxygen depletion of bottom waters, nuisance algal blooms or accumulation, decreased water clarity, etc.) attributed to cultural eutrophication." See United States Environmental Protection Agency, "Beneficial Use Impairment Assessment" *Great Lakes*. Cultural eutrophication "is the process by which lakes and other water bodies are enriched by nutrients (usually phosphorus and nitrogen) [from human activities], which leads to excessive plant growth and oxygen depletion." Government of Ontario and Government of Canada, *St. Lawrence River Area of Concern – Canadian Section – Status of Beneficial Use Impairments*, September 2010.

61 Government of Ontario and Government of Canada, *St. Lawrence River Area of Concern – Canadian Section – Status of Beneficial Use Impairments*, September 2010.

62 ENVI, *Evidence*, 25 February 2014 (April Adams-Phillips, Representative, Mohawk Council of Akwesasne and Chiefs of Ontario).

63 ENVI, *Evidence*, 27 March 2014 (Jeff Ridal).

64 ENVI, *Evidence*, 27 February 2014 (David Ullrich, Executive Director, Great Lakes and St. Lawrence Cities Initiative). The fifth binational area of concern is the Niagara River.

65 ENVI, *Evidence*, 13 February 2014 (Michael Goffin, Regional Director General, Ontario Region, Department of the Environment).

66 Government of Ontario and Government of Canada, *St. Clair River Area of Concern – Canadian Section – Status of Beneficial Use Impairments*, September 2010.

municipal and industrial discharges have degraded the river itself as well as made it the single largest source of contamination in Lake Erie.[67]

In the case of all three of these binational areas of concern, progress has been made in reducing pollution inputs and in cleaning up legacy contamination. However, as one witness put it, it will "require a great deal of cooperation and collaboration to accomplish the ultimate delisting."[68] Because of the significance of the challenges faced, delisting is projected for 2025.[69]

F. Areas of Concern — Summary

The Committee heard that progress is being made to remediate and delist all of Canada's areas of concern in the Great Lakes system. Of the 12 Canadian areas of concern, 3 have been fully remediated and delisted, and 2 others are classified as being "in recovery" on the basis of clean-up activities being complete, but more time is needed for the ecosystem to recover. While it has been noted that much of this progress was made in the early years following the designation of areas of concern under the 1987 *Great Lakes Water Quality Agreement*,[70] Environment Canada testified that the seven remaining Canadian areas of concern are likely to be remediated by 2025.[71]

No new areas of concern have been designated in recent years. The continuing significant contamination at areas of concern is largely the legacy of historic industrial, municipal and urban practices. These practices were carried out before society appreciated the negative impact they would have on the environment, human health and the economy.

With a good deal of research and remedial action, water quality in the Great Lakes, particularly in the areas of concern, has greatly improved over the years. In addition, nuisance algae which, in the 1970s, "resulted in dead areas at the bottom of Lake Erie, and nearshore problems in practically all the lakes,"[72] were largely addressed in the 1980s and 1990s. As described by one witness, these problems of toxic chemicals and nuisance algae were "tackled vigorously by building sewage treatment plants for all municipalities and industries, and regulating phosphorus in detergents and some toxics, such as PCBs and the pesticide DDT."[73]

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67 Government of Ontario and Government of Canada, *Detroit River Area of Concern – Canadian Section – Status of Beneficial Use Impairments*, September 2010.

68 ENVI, *Evidence*, 27 February 2014 (David Ullrich).

69 ENVI, *Evidence*, 13 February 2014 (Michael Goffin).

70 International Joint Commission, *Assessment of Progress Made Towards Restoring and Maintaining Great Lakes Water Quality Since 1987: 16th Biennial Report on Great Lakes Water Quality*, 15 April 2013, p. iv.

71 ENVI, *Evidence*, 13 February 2014 (Michael Goffin and Chris Forbes).

72 "But probably not Lake Superior", ENVI, *Evidence*, 27 March 2014 (James Bruce).

73 Ibid.

While many witnesses who appeared before the Committee believe that remediation of Canada's areas of concern and regulatory measures that reduced certain inputs to the lakes are important and significant, some complex and persistent issues are now emerging as priorities. More specifically, it is now apparent that non-point source pollution is a significant threat to the water quality in certain locations of the Great Lakes Basin.

Non-point source pollution is the cumulative result of contaminants being washed off fields, lawns, streets and other paved areas, either directly into the Great Lakes or their tributaries, or via sewage systems before being discharged into the Great Lakes or their tributaries. Contaminants originate in both rural and urban locations. They include manure and other fertilizers, pesticides and animal waste washed off fields and residential lawns. They result from stormwater runoff in towns and cities, as well as combined sewer overflows.[74]

The chemicals implicated in non-point source pollution include "a host of new contaminants, [such as pharmaceuticals], not removed at conventional sewage treatment plants, finding their way to the lakes."[75] However, many witnesses concurred that the contaminant currently of "dominant concern" is phosphorus.[76]

Problems related to non-point source pollution in the Great Lakes are complicated by the introduction of new invasive species that are changing the food web, by changes in land use and other human interventions as well as by climate change. One witness referred to these factors as "game changers."[77]

Accordingly, it is time to look beyond the areas of concern that have already been identified and to consider the effects of non-point source pollution in the context of other game changing factors and in other locations within the Great Lakes system.

Other Locations of Environmental Concern

Algal blooms, as discussed below, have once again made Lake Erie the "poster child" of water quality issues in the Great Lakes. Two other Great Lakes — Lake Ontario and Lake Huron, along with Georgian Bay — were also identified as locations of environmental concern during this study. Each lake is discussed in turn, below, with a summary of the efforts that are planned or underway to remediate water quality problems in these lakes.

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74 ENVI, *Evidence*, 27 February 2014 (Michael D'Andrea).

75 ENVI, *Evidence*, 27 March 2014 (James Bruce).

76 ENVI, *Evidence*, 27 February 2014 (David Ullrich).

77 Jeff Ridal, Executive Director, St. Lawrence River Institute of Environmental Sciences, written brief, 27 March 2014.

A. Lake Erie

Despite the fact that, in most years, phosphorus loadings to Lake Erie have been below the target established under the *Great Lakes Water Quality Agreement* and have been reduced by more than half from the 1970s levels, algal blooms are once again fouling the nearshore areas of the lake. Following a severe thunderstorm in June 2011, a record-breaking algal bloom covered almost the entire western basin of the lake, an area of approximately 5,000 km^2.[78]

Excessive algae in the lake poses a threat to the safety of drinking water, increases water treatment costs and clogs water intakes.[79] It degrades fish and wildlife habitat with resulting "adverse impacts on tourism and commercial and recreational fisheries,"[80] and it fouls beaches and shorelines, affecting swimming and boating on the lake.

The Committee heard that the "reasons for the resurgence of the algae are complex and not completely understood. Phosphorus levels have declined significantly and are currently stable; however, the proportion of phosphorus in dissolved form is increasing, and this is believed to be contributing to increased algae growth."[81]

Unlike particulate phosphorus, which historically posed problems in Lake Erie, dissolved phosphorus is readily available to be taken up by algae.[82] The increase in the proportion of dissolved phosphorus in the lake appears to be partially attributable to changing farm practices, including "no till" farming, which results in increased amounts of dissolved phosphorus seeping in the waterways.[83] Point sources, such as industrial and sewage discharges, also contribute dissolved phosphorus to the lakes.[84]

In addition to changes in farming practices, new aquatic invasive species may play a role in increasing the amount of dissolved phosphorus in the lake.[85] It is thought that zebra mussels and now quagga mussels, which dominate nearshore areas of Lake Erie and other Great Lakes, are filtering particles, such a phytoplankton, and releasing nutrients in forms more easily used by bloom-forming algae. The mussels also improve water clarity

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78 ENVI, *Evidence*, 25 February 2014 (Gordon Walker); ENVI, *Evidence*, 27 March 2014 (William Taylor).

79 ENVI, *Evidence*, 13 February 2014 (Chris Forbes).

80 Ibid.

81 Ibid.

82 ENVI, *Evidence*, 13 February 2014 (Patricia Chambers, Section head, Watershed Stressors and Nutrients, Science and Technology Branch, Environment Canada).

83 Ibid.

84 Ibid.

85 Ibid. (David Burden).

and therefore light penetration, and act as a substrate for certain types of algae to bind to the lake bottom.[86]

Finally, climate change also appears to be exacerbating the situation. Warming weather causes more evaporation from the lakes, including during winter months if there is not enough ice cover.[87] Increased evaporation leads to lower water levels, particularly in the shallow nearshore areas, which warm faster, promoting algal growth. In addition, more dissolved phosphorus is entering waterways as a result of "more runoff with increased frequency of heavy rain and snowmelt periods in the changing climate."[88]

While numerous witnesses identified Lake Erie — and in particular the western basin of Lake Erie — as a location of concern within the Great Lakes Basin, they pointed out that the watersheds that drain into the lake must also be considered.[89] It has been determined that the Maumee River in Ohio is responsible for about 80% of the water quality impairment in the Western Lake Erie Basin.[90] On the Canadian side, "the Thames River has been recognized, sadly, as the area of greatest contribution. … Other watersheds, including the Grand River watershed, have been mentioned as having significant input into Lake Erie, and what would apply in the Lower Thames would be applicable in the Grand as well."[91] Accordingly, these tributaries, and the watersheds they drain, might be considered locations of concern within the Great Lakes Basin.[92]

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86 International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms*, *Report of the Lake Erie Ecosystem Priority*, February 2014, p. 35. Also see R.E. Hecky, "The nearshore phosphorus shunt: a consequence of ecosystem engineering by dreissenids in the Laurentian Great Lakes", *Can. J. Fish. Aquat. Sci*, Vol. 61, 2004.

87 ENVI, *Evidence*, 27 March 2014 (James Bruce).

88 Ibid.

89 ENVI, *Evidence*, 25 February 2014 (Joe Farwell, Chief Administrative Officer, Grand River Conservation Authority).

90 ENVI, *Evidence*, 25 March 2014 (Don Pearson, General Manager, Lower Thames Valley Conservation Authority).

91 Ibid. Note that the Thames River drains into Lake St. Clair, which in turn flows into the western basin of Lake Erie. The Grand River flows into the eastern basin of Lake Erie. "Efforts to reduce phosphorus inputs into the eastern basin will have little impact on algal bloom and hypoxic conditions occurring upstream. However, reduced phosphorus inputs into the eastern basin will benefit the local environment as well as Lake Ontario, which receives 80% of its flow from Lake Erie." International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms*, *A Report of the Lake Erie Ecosystem Priority*, February 2014, pp. 7–8.

92 ENVI, *Evidence*, 4 March 2014 (Ian Wilcox, General Manager and Secretary-Treasurer, Upper Thames River Conservation Authority); ENVI, *Evidence*, 25 February 2014 (Gordon Walker); ENVI, *Evidence*, 1 April 2014 (Jan Ciborowski, Professor, University of Windsor, as an Individual).

1. Remedial Efforts Underway for Lake Erie

Local authorities and organizations, as well as governments at all levels, are taking action to decrease phosphorus inputs from non-point sources to Lake Erie.

Currently, remedial actions to change agricultural practices are occurring largely at the local level. Conservation authorities, which are responsible for managing the water and resources on a watershed basis, develop and implement a range of local conservation programs, improving water quality and creating green jobs. "For example, the Upper Thames River Conservation Authority's clean water program secures funding from foundations, the private sector, municipalities, and provincial and federal partners to offer incentives to private landowners for water quality best management practices. Examples of eligible projects include erosion control measures, remediation of faulty septic systems, restriction of livestock from watercourses, clean water diversions, and nutrient management plans."[93]

A representative from the Lower Thames Valley Conservation Authority described for the Committee that organization's new partnership arrangement with the Ontario Ministry of Agriculture and Food to enhance understanding of how phosphorus travels over land, including mechanisms, times of year and factors that influence its transport. Recently, the four conservation authorities responsible for the western basin of Lake Erie — the Essex Region, Lower Thames Valley, St. Clair Region, and Upper Thames River conservation authorities — have "agreed to collaborate to pursue enhanced and stronger implementation measures for this critical area of Lake Erie."[94] The Committee also heard from a representative from the Grand River Conservation Authority, who stated that the federal government has been a strong supporter in the development of its water management plan and described some of the initiatives underway at that organization in support of improved water quality of the Grand River, which flows into the eastern end of Lake Erie.[95]

The Canada-Ontario Farm Stewardship Program, which is colloquially referred to as the "environmental farm plan,"[96] is also contributing to a reduction in phosphorus inputs to the lake. This cost-shared program helps "to change farmers' attitudes toward the environment, raising the awareness of regulatory requirements, and promoting the adoption of best practices to address on-farm risks."[97] Projects funded under the environmental farm plan include those aimed at improving manure storage and handling, enhancing well water protection, establishing buffer strips around streams and controlling

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93 Ibid. (Ian Wilcox).

94 Ibid.

95 ENVI, *Evidence*, 25 February 2014 (Joe Farwell).

96 Ibid. (Jim Richardson).

97 Ibid.

soil erosion. Of the approximately 59,000 farms in Ontario, 13,000 different farms have been funded under the program to implement 23,000 best practices.[98]

Despite these efforts, too much phosphorus is still finding its way into Lake Erie. As one witness noted, "if actual lake and tributary water quality is our true outcome measure, [the programs of Conservation Authorities] have been inadequate."[99] Accordingly, governments at all levels are engaged in finding and implementing solutions.

At the binational level, following the 2011 record algal bloom, the International Joint Commission "launched its major effort into the Lake Erie ecosystem priority, also known as LEEP. To address the challenge, dozens of scientists from both countries were brought together to examine scientific, socio-economic, and regulatory dimensions of the issues in both countries as part of a comprehensive approach."[100]

The final LEEP report was published in February 2014.[101] It contains 16 recommendations, the first of which is for the Canadian and United States governments to "adopt new targets for maximum acceptable phosphorus loadings in Lake Erie."[102] Other recommendations include:

- Refocus agri-environmental management programs to explicitly address dissolved reactive phosphorus…;
- Ban the application of manure, biosolids, and commercial fertilizer containing phosphorus on frozen ground or ground that is covered by snow…;
- Accelerate the use of green infrastructure, such as rain gardens and green walls, in urban stormwater management…;
- Prohibit the sale and use of phosphorus fertilizers for lawn care except in certain circumstances…;
- Increase … coastal wetland areas in the western basin of Lake Erie by the year 2030…; and
- Enhanc[e] monitoring networks throughout the Lake Erie basin, including the establishment of a monitoring system at the outlet of the Detroit River that measures phosphorus and other critical nutrient parameters.[103]

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98 Ibid.

99 Ibid. (Ian Wilcox).

100 ENVI, *Evidence*, 25 February 2014 (Gordon Walker).

101 International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms*, *A Report of the Lake Erie Ecosystem Priority*, February 2014.

102 Ibid., p. 8.

103 ENVI, *Evidence*, 25 February 2014 (Gordon Walker).

At the federal level, representatives from Environment Canada testified that under the 2012 *Great Lakes Water Quality Agreement,* the governments of Canada and the United States are committed to establishing revised binational phosphorus reduction targets by 2016, and to establishing phosphorus reduction plans by 2018.[104] "Through the Great Lakes nutrient initiative, $16 million is being directed to research and monitoring to better understand the causes of toxic and nuisance algae growth, and to provide data and information necessary to establish new phosphorus reduction targets."[105] As described by one witness:

> The Great Lakes Nutrient Initiative has provided funds to monitor 12 of the Canadian tributaries flowing into Lake Erie that haven't been sampled for about five or six years previously. That includes the Grand, the Sydenham, the Thames, and the Detroit River, which is being monitored for 24 hours a day throughout the year, in winter as well as in summer. It is a major impetus of the nutrient initiative to understand what is the linkage between the phosphorus loading and the manifestations of these algal blooms that we're seeing.[106]

Environment Canada is also "working with conservation authorities in key watersheds to demonstrate best practices in watershed planning and management."[107]

Other federal departments are also involved in the effort to improve water quality in Lake Erie. Researchers with Agriculture and Agri-Food Canada "are investigating strategies to manage nitrogen, phosphorus, and manure in pursuit of improved agricultural practices that improve crop nutrient utilization and reduce losses to the surrounding ecosystem."[108] Fisheries and Oceans Canada "supports the restoration, rebuilding and rehabilitating of recreational fisheries habitat through the Recreational Fisheries Conservation Partnerships Program, which in 2013 allocated approximately $1.3 million of eligible funds for recreational fisheries enhancement work in the Great Lakes watershed."[109] Additional funding for this program was offered in the 2014 budget.[110]

A representative of the Ontario provincial government described for the Committee the province's three main initiatives to protect, monitor and remediate water quality of the Great Lakes, including Lake Erie. First, Ontario's Great Lakes strategy "provides a road map to focus tools and resources across ministries as well as priorities for action and collaboration with the broader Great Lakes community."[111] Second, Ontario's proposed

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104 ENVI, *Evidence*, 13 February 2014 (Chris Forbes).

105 Ibid.

106 ENVI, *Evidence,* 1 April 2014 (Jan Ciborowski).

107 ENVI, *Evidence*, 13 February 2014 (Chris Forbes).

108 Ibid. (Ian Campbell, Director, Science Coordination Division, Science and Technology Branch, Agriculture and Agri-Food Canada).

109 Ibid. (David Burden).

110 Ibid.

111 ENVI, *Evidence*, 4 March 2014 (Maurice Bitran).

Great Lakes Protection Act, which is currently before the legislature, "would provide the Government of Ontario with a more comprehensive suite of tools to address the combined stresses on the Great Lakes at a multiple watershed scale."[112] Third, under the *Canada-Ontario Agreement* — the eighth version of which the federal government has recently signed on to and is currently available for public comment prior to finalization — Ontario works with the federal government to address Great Lake issues, including cleanup of the five remaining areas of concern.[113]

Ontario's Ministry of Agriculture and Food and the Ministry of Rural Affairs are also involved in improving Great Lakes water quality, focussing on research, education and awareness, and stewardship practices to support Ontario's Great Lakes strategy.[114] With regards to research, the province provides funding through a variety of partnerships and academic institutions to develop effective best-management practices. Under the best practices verification and demonstration program, field testing is performed on new practices to address challenges such as extreme weather events.[115]

Lake Erie is the shallowest and warmest of all the Great Lakes, and its basin "is the most densely populated of the five Great Lake basins, with 17 metropolitan areas with populations of more than 50,000 and a total population of 11.6 million."[116] Accordingly, Lake Erie is the most affected by problem algal blooms. However, "the shorelines of Lake Ontario and southeastern Georgian Bay and Lake Huron also experience adverse impacts [of nuisance algal blooms],"[117] as well as other water quality issues, which led witnesses to describe those other lakes as locations of environmental concern as well.

B. Lake Ontario

Lake Ontario, and in particular the western end of Lake Ontario rimmed by the Golden Horseshoe — the highly populated area that stretches from Niagara around the western end of Lake Ontario through Hamilton to the eastern edge of the Greater Toronto Area, and perhaps as far as Port Hope — was identified as a location of environmental concern within the Great Lakes Basin.[118] Lake Ontario currently has four Canadian areas of concern under the *Great Lakes Water Quality Agreement* undergoing remediation.[119]

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112 Ibid.

113 Ibid.

114 ENVI, *Evidence*, 4 March 2014 (Jim Richardson).

115 Ibid.

116 International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms*, *A Report of the Lake Erie Ecosystem Priority*, February 2014, p. 24.

117 ENVI, *Evidence*. 13 February 2014 (Chris Forbes).

118 ENVI, *Evidence*, 25 March 2014 (Bonnie Fox, Manager, Policy and Planning, Conservation Ontario); 2014 (Conrad deBarros, Project Manager, Toronto and Region Remedial Action Plan, Watershed Management, Toronto and Region Conservation Authority).

119 The four Canadian areas of concern on Lake Ontario are Hamilton Harbour, Toronto and Region, Port Hope Harbour and Bay of Quinte. See Environment Canada, *Great Lakes Areas of Concern*.

Two, or arguably three, of these areas of concern are within the Golden Horseshoe. However, even once the historical pollution in these areas of concern is fully remediated, the western end of Lake Ontario will remain a location of concern owing to its location as the "downstream recipient of pollution from the other Great Lakes and the Niagara River"[120] and its strong population growth with concomitant urbanization and pollution that threatens water quality.

The Golden Horseshoe has one of the fastest growing populations in North America. "By 2031 the population in this area is expected to increase by almost 4 million people above the 2001 census to 11.5 million people, accounting for over 80% of Ontario's growth."[121]

As one witness explained, "urbanization is causing stress on loss of natural cover and habitat, which affects the hydrologic cycle and water quality."[122] The development of natural areas, including protective coastal wetlands, for residential and commercial purposes, and specifically the paving over of natural ground, results in runoff reaching the lake faster.

Even water that is treated at a conventional sewage treatment plant before being discharged into the environment contains certain toxic chemicals that have not been removed. As one witness explained, when Canada and the United States banned PCBs and other chlorinated chemicals, they were replaced by new chemicals, such as polybrominated diphenyl ethers and other flame retardants and perfluorinated chemicals, which are now being found in increasing quantities in the environment.[123] Pharmaceuticals are also finding their way into the lakes.[124]

Phosphorus is also degrading water quality in Lake Ontario and in Lake Erie. Excessive algal growth in nearshore areas of the lake "threatens water quality, clogs water intakes at power plants, potentially resulting in unscheduled shutdowns, and when this algae breaks off from the bottom, it washes up onto shore and forms unsightly and very foul-smelling piles."[125] This algal growth is fuelled by tributary phosphorus loading, which was measured at 234% higher than that of wastewater treatment plants in 2008. Exacerbating factors include the invasion of zebra and quagga mussels.[126]

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120 ENVI, *Evidence*, 8 April 2014 (Conrad deBarros).

121 Ibid.

122 Ibid.

123 ENVI, *Evidence*, 3 April 2014 (Jules Blais, Professor, University of Ottawa, as an Individual).

124 ENVI, *Evidence*, 27 March 2014 (James Bruce).

125 ENVI, *Evidence*, 8 April 2014 (Conrad deBarros).

126 Ibid.

These next generation water quality concerns of Lake Ontario and of the other Great Lakes — including toxic chemicals and phosphorus — affect drinking water quality, disrupt food webs and ecosystems and generally impair beneficial uses of the lake.

1. Remedial Efforts Underway for Lake Ontario

Around the Golden Horseshoe, municipalities are improving their management of storm- and wastewater. The City of Toronto has embarked on a $1.5 billion Wet Weather Flow Master Plan to address storm sewer and combined sewer overflow discharges to the lake, as discussed earlier in this report.[127] As a second example, the City of Hamilton is making major upgrades and adding tertiary treatment to its wastewater facilities.[128]

The federal government is contributing funding to support wastewater projects. A representative from Infrastructure Canada testified that, since 2006, the department has supported 173 projects in the Great Lakes Basin, committing $631 million out of $1.8 billion in wastewater projects.[129] He also explained that, "in addition to investments through direct contribution programs, the Government of Canada has provided significant investments to wastewater infrastructure through the Gas Tax Fund. Based on reports received from our provincial partners, Ontario municipalities have spent approximately $94 million of their federal gas tax funds on wastewater projects since 2005."[130] Finally, he testified that "wastewater infrastructure will continue to be an eligible category of investment under the New Building Canada Plan. Recognizing that improving wastewater treatment and related infrastructure remains a priority for provinces and municipalities, wastewater will be an eligible category under the $10-billion provincial and territorial infrastructure component of the New Building Canada Plan as well as the renewed federal Gas Tax Fund."[131]

Efforts to expand green infrastructure and remediate natural areas around the Golden Horseshoe are also under way. A partnership of municipal, provincial and federal agencies, termed Aquatic Habitat Toronto, is responsible for "the Toronto waterfront aquatic habitat restoration strategy, which involves habitat mitigation, restoration and supporting science."[132] The Committee heard that "about 35 hectares of wetland and fish habitat along the waterfront that have been restored" in Toronto, with still more to be done.[133]

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127 ENVI, *Evidence*, 27 February 2014 (Michael D'Andrea); ENVI, *Evidence*, 8 April 2014 (Conrad deBarros).

128 ENVI, *Evidence*, 27 February 2014 (Chris Murray).

129 ENVI, *Evidence*, 13 February 2014 (Jeff Moore, Assistant Deputy Minister, Policy and Communications, Infrastructure Canada).

130 Ibid.

131 Ibid.

132 Ibid. (David Burden).

133 ENVI, *Evidence*, 8 April 2014 (Conrad deBarros).

C. Lake Huron

Lake Huron, and Georgian Bay in particular, were also mentioned by witnesses as a location of environmental concern. Similar to lakes Erie and Ontario, over-enrichment due to phosphorus inputs is a problem in nearshore environments of Lake Huron. In some areas, such as Sturgeon Bay in the Pointe au Baril area of eastern Georgian Bay, "water cannot be touched let alone used for drinking due to smell, taste, and possible toxicity."[134]

However, distinct from the other Canadian Great Lakes, for about 14 or 15 years, Lake Huron has been experiencing the complicating factor of sustained low water levels.[135] Low water levels pose certain obvious problems for shipping and recreation, but they also may affect water quality. As explained by one witness, "when wetlands become cut off from Georgian Bay because of the low water levels, we also see significant changes in the nutrient chemistry and overall water-quality conditions in the bay."[136] Another witness gave the example of Sturgeon Bay, where low water levels impede exchanges with the open water that would ordinarily dilute phosphorus concentrations. This results in "the right conditions … for … blue-green algae blooms, which then degrade the use of the water."[137]

Low water levels degrade coastal wetlands, which in turn impedes the natural water purification and other ecosystems services those wetlands provide.[138] Even if water levels do not drop to the point where a coastal wetland dries up or gets cut off from the open water, lower water temperatures,[139] with potentially dangerous consequences for certain species.[140] The Committee learned that "the eastern Georgian Bay coastal area has among the most diverse and most productive fish habitat in the Great Lakes" but that they were being severely degraded by low water levels.[141]

There appear to be multiple causes of sustained low water levels in Lake Huron, along with Lake Michigan, which are lobes of the same lake. One cause is dredging of the St. Clair River in the 1950s and 1960s, and subsequent erosion in the same area, which has resulted in water flowing out of the system at a greater rate. Another cause of low water levels that a number of witnesses pointed to is climate change. Climate change is

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134 ENVI, *Evidence*, 1 April 2014 (David Sweetnam Executive Director, Georgian Bay Forever).

135 Ibid. (Mary Muter, Vice Chair, Restore Our Water International, Sierra Club of Canada); ENVI, *Evidence*, 27 March 2014 (Patricia Chow-Fraser).

136 Patricia Chow-Fraser, speaking notes, 27 March 2014, p. 6.

137 ENVI, *Evidence*, 1 April 2014 (David Sweetnam).

138 ENVI, *Evidence*, 27 March 2014 (Patricia Chow-Fraser).

139 In a letter dated 11 April 2014, David Sweetnam, Executive Director of Georgian Bay Forever, cites data of Dr. Andrew D. Gronewold of the National Oceanic and Atmospheric Administration suggesting that the temperature of surface water of Lakes Michigan and Huron has increased by an average of 1.908 degrees Celcius since 1995.

140 ENVI, *Evidence*, 27 March 2014 (Patricia Chow-Fraser).

141 ENVI, *Evidence*, 3 April 2014 (Robert Florean).

linked to increased runoff as a result of more frequent extreme storms,[142] but also has been causing less ice cover in winter, which increases evaporation and lowers water levels.

1. Remedial Actions Underway for Georgian Bay

Many of the same programs and strategies being deployed to address phosphorus inputs to the other lakes also apply in the context of Lake Huron. Specific to the Georgian Bay area, a local charity called Georgian Bay Forever has worked "with coastal municipalities to establish common protocols for water quality testing, which townships around the bay can use to monitor the quality of water in their areas."[143] Further, that group is "building on this work by adding new diagnostic tools, such as microbial source tracking, to better understand the origins of contaminants and inform better management decisions."[144]

The federal government has established the Lake Simcoe and South-eastern Georgian Bay Clean-Up Fund, which has "allocated $32 million and leveraged $51 million to support nearly 200 phosphorus reduction projects."[145] The Committee heard from representatives from Ducks Unlimited Canada, which is receiving $370,000 of this funding for a project "to increase the overall awareness of wetlands and wetland conservation issues [in the Georgian Bay and Lake Simcoe area]."[146] Elements of the project include wetland restoration activities, wetland mapping and outreach to "land planners and partners on the landscape, so that they can begin to understand and incorporate wetlands conservation in their official planning processes and in their overall municipal planning."[147]

Representatives from the Government of Ontario also discussed efforts underway to protect wetlands, not just in the Georgian Bay area, but across the province. Specifically, they referenced a provincial policy statement whose goal is to protect the most significant wetlands in Ontario, "particularly those that have an impact on things like water quality and the quantity of the Great Lakes."[148]

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142 ENVI, *Evidence*, 8 April 2014 (Nancy Goucher, Program Manager, Environmental Defence Canada).

143 ENVI, *Evidence*, 1 April 2014 (David Sweetnam).

144 Ibid.

145 ENVI, *Evidence*, 13 February 2014 (Chris Forbes).

146 ENVI, *Evidence*, 1 April 2014 (Mark Gloutney, Director, Regional Operations, Eastern Region, Ducks Unlimited Canada).

147 Ibid.

148 ENVI, *Evidence*, 4 March 2014 (Brian Nixon, Director, Ministry of the Environment, Integrated Environmental Policy Division, Government of Ontario).

BEST PRACTICES TO FACILITATE FURTHER REMEDIATION OF THE GREAT LAKES

A great deal has been learned about how to remediate and protect water quality in the Great Lakes since the 1960s and 1970s. As previously mentioned, three of Canada's areas of concern have been delisted, and two more are "in recovery." Priority actions for the delisting of five more areas of concern are planned to be complete over the next five years,[149] and the goal is to delist the final seven areas of concern by 2025.[150] A body of best practices in the remediation of areas of concern is building, and with it the pace of delisting areas of concern is picking up.

The Great Lakes, however, are a dynamic system subject and reacting to change. The resurgence of algal blooms, despite continued lower phosphorus inputs, points to new forces that must be taken into account in planning remediation efforts. Non-point sources of phosphorus and other pollutants are now of significant concern. The Great Lakes system's response to these inputs is complicated by other changes occurring in the system resulting from invasive species, climate change and the influence of a growing population in the region.

For these reasons, the Committee asked witnesses about remediation efforts underway or planned in their areas in order for it to make recommendations regarding best practices that will facilitate further remediation of areas of environmental concern within the Great Lakes Basin. Some witnesses described efforts taking place or planned to remediate specific areas of concern. Other witnesses described efforts underway to address the newer problem of non-point source pollution, particularly phosphorus. Finally, the need to prevent future water quality issues in the face of environmental change was also discussed. The following sections present the Committee's observations regarding best practices obtained from testimony on these three themes.

Best Practices in Remediating Areas of Concern

Best practices for remediating water quality include both "best physical techniques," such as methods to manage contaminated sediments or design sewer infrastructure, as well as "best processes," which are means of ensuring that these techniques are implemented efficiently and effectively. The Committee heard of many best physical techniques, but did not study them in any depth. However, the Committee heard a great deal of testimony regarding "best processes," including best means of developing and implementing remediation efforts, as well as techniques for sharing best practices, particularly in the context of areas of concern.

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149 Ibid. (Maurice Bitran).

150 Ibid.; ENVI, *Evidence*, 13 February 2014 (Chris Forbes and Michael Goffin).

A. Best Means of Developing and Implementing Remediation Efforts

The remediation process involves identifying problems and finding solutions. As the Committee heard, it is a collaborative effort involving "a number of federal and provincial agencies, but also involved members of the community from the first nations, industry, municipalities, conservation authorities, non-profits, and other members of the public."[151] Remediation of areas of concern is an enormous task. It requires significant collaboration and participation, particularly on the part of the community, including any local First Nations.

Various witnesses testified that when members of local communities are involved in the remediation process, they come up with solutions. "The remedial action plans are populated almost entirely by volunteers, by people who are participating in helping to solve the problem."[152]

Many examples were given of the importance of community involvement in developing remediation plans. Indeed, many community groups testified during the study. In the case of every area of concern addressed during the study, the local community was engaged in identifying key environmental issues to be addressed in a remedial action plan and in implementing the plan.[153] For example, in Hamilton, the Bay Area Restoration Council (BARC) "encourages community activity and action by offering school programs, volunteer programs and events, community workshops, evaluative reporting on current issues, and opportunities for digital engagement and promotion."[154] The outreach function of BARC was cited as a best practice in community involvement.[155]

A second example of a collaborative initiative held up as a best practice is found in the St. Lawrence River Institute, which originated from the areas of concern remediation process. This unique organization has education and public engagement at its core. The Executive Director of the Institute noted a number of methods by which the public is involved in the Bay of Quinte area of concern:

> Also important in both of these [areas of concern] has been public engagement, engaging the public in the process. For example, the landowners who were involved in these [best management practice] implementations are volunteers. We have public consultation and other mechanisms, and even children's water festivals that happen both at the St. Lawrence [area of concern], with over 2,000 students being educated each year on these issues, and at the Bay of Quinte. For the last 21 years, our river institute has

151 ENVI, *Evidence*, 27 March 2014 (Jeff Ridal).

152 ENVI, *Evidence*, 25 February 2014 (Gordon Walker).

153 ENVI, *Evidence*, 27 March 2014 (Jeff Ridal).

154 ENVI, *Evidence*, 8 April 2014 (Chris McLaughlin).

155 ENVI, *Evidence*, 13 February 2014 (Michael Goffin).

hosted an annual symposium to talk about Great Lakes water quality and St. Lawrence water quality.[156]

In addition to the importance of community engagement in the collaborative remedial process, witnesses also made it clear that it is important to involve First Nations in a "respectful and cooperative way."[157] First Nations have a key role in improving the Great Lakes fishery as it is important to Aboriginal interests.[158] In the case of the St. Lawrence River area of concern, "respectful and cooperative relationships have been developed based on focusing on common interests of a healthy river for all."[159]

B. Techniques for Sharing Best Practices

Areas of environmental concern have both unique and shared characteristics. Hamilton Harbour contains a large coal tar deposit at Randle Reef. Toronto has a significant waste- and stormwater management challenge. The Bay of Quinte has sediments contaminated with arsenic. These challenges may seem to be unique, but they have commonalities. Waste- and stormwater management is needed in all regions, particularly in urban areas in both Canada and the United States, but also on agricultural lands. Sediment contamination is a common problem in many areas of concern, even though the contaminant may vary from area to area.

As a result of these commonalities, and because jurisdictions have different capacities to deal with water quality problems, sharing techniques is vital. For instance, it was suggested that the sediment management techniques used for Randle Reef could also be used to help remediate the Thunder Bay area of concern.[160] It was also noted that Toronto's Wet Weather Flow Master Plan "has set an example for across the basin."[161]

However, ensuring that everyone has access to these ideas, let alone resources to put them in place, is challenging. As one witness expressed it, "honestly, people in cities are … so busy dealing with the next crisis that even being able to sit down and write down the key elements [of the best practices they have devised is a challenge.]"[162]

However, some initiatives are underway to facilitate sharing best practices. The Great Lakes and St. Lawrence Cities Initiative has a website devoted to best practices as well as a similar Municipal Adaptation and Resiliency Service targeted at climate change adaptation techniques.

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156 ENVI, *Evidence*, 27 March 2014 (Jeff Ridal).

157 ENVI, *Evidence*, 25 February 2014 (April Adams-Phillips).

158 Ibid.

159 Ibid.

160 ENVI, *Evidence*, 13 February 2014 (Michael Goffin).

161 ENVI, *Evidence*, 27 February 2014 (David Ullrich).

162 Ibid.

People gathering to discuss issues is also a good way to disseminate ideas. One example given to the Committee was a binational meeting where a large-scale farmer described how he uses a mulch that retains water and nutrients in the soil and prevents runoff when left on fields.[163] Another example was given where the idea of low technology but much-appreciated wheelchair access to beaches was disseminated at an annual meeting.[164]

Industry can also form networks to share best practices. For example, the Committee heard of wastewater treatment plant operators building a community to share best practices, particularly regarding the optimization of their systems.[165]

Information on best practices can also be disseminated through programs delivered by all levels of government. For example, a witness testified that environmental farm plans have funded 23,000 best practices over about 13,000 different farms of the 59,000 farms in Ontario.[166] The program includes workshops as well as funding opportunities. The Committee was told that some people attend the workshops in order to learn about and implement best practices without even receiving the funding.[167] As a second example, Environment Canada is "also working with conservation authorities in key watersheds to demonstrate best practices in watershed planning and management."[168]

Applying Best Practices on a Broader Scale to Address Non-Point Source Pollution

Many of the Great Lakes' water quality problems of the 1970s were addressed primarily through regulations and government funding: phosphorus in detergents was limited, toxic chemicals such as PCBs and DDT were banned, and governments on both sides of the border invested billions of dollars in wastewater treatment plants.[169] While one of the principal causes of degraded water quality in the 1970s — phosphorus — has re-emerged as a key factor in today's water quality issues, the same mix of approaches that worked so well to clean up the Great Lakes in the 1970s and 1980s is not applicable to current circumstances.

Unlike the 1970s, today's water quality issues are characterized by non-point sources of pollution, which are not so readily addressed through regulation and infrastructure improvements. As expressed by one witness, "the only effective strategy for managing and reducing these inputs is targeted and sustained non-point source control

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163 ENVI, *Evidence*, 1 April 2014 (Mary Muter).

164 ENVI, *Evidence*, 27 February 2014 (David Ullrich).

165 ENVI, *Evidence*, 25 February 2014 (Joe Farwell).

166 ENVI, *Evidence*, 4 March 2014 (Jim Richardson).

167 Ibid.

168 ENVI, *Evidence*, 13 February 2014 (Chris Forbes).

169 ENVI, *Evidence*, 27 March 2014 (James Bruce); ENVI, *Evidence*, 25 February 2014 (Gordon Walker).

programs, focussed on urban and rural sources alike."[170] Numerous examples were given of best practices which can be used to address non-point sources of pollution.

For rural and agricultural areas, best practices include:

- applying "the right fertilizer source at the right rate, at the right time, and in the right place";[171]
- not spreading manure on frozen or snow-covered ground where it will not sink in;[172]
- maintaining cover crops;[173]
- inspecting, maintaining and upgrading septic systems;[174]
- containing stored manure in secure structures;[175]
- recovering nutrients from wastewater;[176] and
- maintaining buffer zones and other structures in riparian areas to control runoff and erosion.[177]

In the urban context, one witness succinctly described the non-point source problem:

> Hard surfaces and other forms of development like parking lots and roofs and so forth don't allow stormwater to infiltrate into the ground. The water is conveyed very quickly, it picks up pollutants, and reaches receiving waters without treatment. We need to slow that water down, we need to hold it back and allow it to travel through the landscape more slowly and release or deposit some of those nutrients like phosphorus, for example, and *E. coli* and other materials before they reach receiving waters.[178]

As explained by another witness, "the way you treat stormwater is that you treat it at the source to try to reduce the impact, you treat it as it's being conveyed to the

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170 Don Pearson, Lower Thames Valley Conservation Authority, written brief, 25 March 2014.

171 ENVI, *Evidence*, 13 February 2014 (Ian Campbell); ENVI, *Evidence*, 25 March 2014 (Terry Murphy).

172 ENVI, *Evidence*, 25 February 2014 (Gordon Walker).

173 Ibid. (Joe Farwell).

174 ENVI, *Evidence*, 27 March 2014 (Jeff Ridal).

175 Ibid.; ENVI, *Evidence*, 13 February 2014 (Ian Campbell).

176 Ibid. (Ian Campbell).

177 Ibid.; ENVI, *Evidence*, 25 March 2014 (Terry Murphy).

178 ENVI, *Evidence*, 8 April 2014 (Chris McLaughlin).

tributaries, and you deal with it at end of pipe."[179] Best management practices cited in this regard include:

- changing attitudes towards property "from straight mowed lawns";[180]
- having more natural areas or at least porous surfaces rather than hard surfaces for more natural water infiltration;[181]
- constructing stormwater ponds or wetlands;[182]
- if space is constrained, constructing underground water storage systems;[183]
- disconnecting downspouts from the sewer system;[184]
- "introducing leaky pipes instead of the conventional plastic or concrete pipes for stormwater runoff";[185] and
- maintaining roadside ditches rather than installing sidewalks and underground storm sewers.[186]

End-of-pipe water treatment is generally improved by adding infrastructure. However, one witness explained to the Committee that a best practice to follow before large investments are made in infrastructure is to optimize existing treatment facilities to "work… the plants to their fullest possible capacity" to "maximize the extraction of nutrients and harmful things from the sewage stream."[187]

A final best practice discussed by a number of witnesses applies to rural regions and urban centres alike: restoring wetlands and constructing more wetland acres around all the Great Lakes, which could have a significant beneficial impact on water quality.[188] One means of possibly achieving this end is through habitat banking, under which wetland loss is allowed if habitat is created or enhanced elsewhere to compensate. While there

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179 Ibid. (Conrad deBarros).

180 Ibid.

181 ENVI, *Evidence*, 25 March 2014 (Bonnie Fox).

182 ENVI, *Evidence*, 27 February 2014 (Michael D'Andrea).

183 Ibid.

184 Ibid.

185 Ibid.

186 Ibid.

187 ENVI, *Evidence*, 25 February 2014 (Joe Farwell).

188 ENVI, *Evidence*, 25 February 2014 (Gordon Walker); ENVI, *Evidence*, 1 April 2014 (James Brennan, Director, Government Affairs, Ducks Unlimited Canada); ENVI, *Evidence*, 25 March 2014 (Don Pearson).

was some support for this concept,[189] one witness thought that habitat banking could be perceived as "simply licensing somebody to destroy something."[190]

Witnesses agreed that best practices such as those mentioned above have been scientifically proven to be effective.[191] Further, witnesses testified that voluntary and incentive-based stewardship programs effectively encourage the adoption of best practices by "pull[ing] everybody together" to contribute time and resources.[192]

Yet, despite initiatives to educate the public and support the adoption of best practices, Great Lakes water quality in many areas is still unsatisfactory. This discrepancy was explained by the extent to which best practices have been adopted. As expressed by one witness: "It really is a sense of scale. What we really need across the Great Lakes is a program of implementation of best management practices. The greater the scale, the greater the uptake within the watershed, the more improvements you'll see."[193] One witness was in agreement that scaling up best practices could be achieved by "setting up a large-scale ecological goods and services program across Canada."[194] Numerous other witnesses expressed the idea that more funding for incentive and education programs would increase the implementation of best practices.[195]

While there was widespread agreement that voluntary and incentive-based stewardship programs are necessary, some witnesses also suggested that, in certain circumstances, regulation may be an appropriate complementary means of tackling non-point sources of pollution.

Several witnesses urged caution in attempting to regulate a solution to non-point source pollution. One witness emphasized that there is no guarantee that regulations would be effective in all areas. In particular, uncertainty remains surrounding the extent to which some water quality problems in the Great Lakes are the result of a changing food web because of invasive species rather than excessive inputs of non-point source phosphorus. While it is widely accepted that reductions of phosphorus inputs into Lake Erie are necessary, scientists are less sure that reductions would be effective for Lake Huron, for instance.[196] Furthermore, regulations may "interfere… with farmers

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189 ENVI, *Evidence*, 1 April 2014 (James Brennan).

190 ENVI, *Evidence*, 25 March 2014 (Don Pearson).

191 ENVI, *Evidence*, 4 March 2014 (Ian Wilcox).

192 ENVI, *Evidence*, 3 April 2014 (Robert Florean).

193 ENVI, *Evidence*, 27 March 2014 (Jeff Ridal).

194 ENVI, *Evidence*, 1 April 2014 (Mary Muter).

195 ENVI, *Evidence*, 4 March 2014 (Ian Wilcox and Jim Richardson); ENVI, *Evidence*, 3 April 2014 (Theresa McClenaghan, Executive Director and Counsel, Canadian Environmental Law Association); ENVI, *Evidence*, 25 March 2014 (Don Pearson).

196 ENVI, *Evidence*, 27 March 2014 (William Taylor).

making a living and with what consumers want to purchase and do with their homes,"[197] which naturally results in resistance to regulations.

Nonetheless, there may be limited circumstances in which new regulatory measures could be effective and generally accepted. Witnesses suggested that consideration could be given to regulating the following practices:

- spreading manure or any other fertilizer containing phosphorus on frozen ground or ground that is covered by snow;[198]
- maintaining crop cover to prevent erosion and phosphorus delivery in the spring;[199]
- routine inspecting of septic systems, or inspecting septic systems at the time of title transfer, if there is a sale of property;[200]
- including phosphorus in certain consumer products, which could be addressed through amendments to the *Concentration of Phosphorus in Certain Cleaning Products Regulations* under the *Canadian Environmental Protection Act, 1999*;[201] and
- using synthetic fertilizers for agricultural purposes at times of the year when crops cannot take up nutrients.[202]

However, not all regulatory measures need be structured in a classic command and control model. As one witness pointed out, "the regulatory policy category also includes tools that focus on training, certification, and cross-compliance between programs, all of which are effective, as well as more publicly palatable."[203] An example of regulation providing for cross-compliance among programs is a situation where a landowner is required to complete an environmental farm plan before being eligible to participate in an incentive program.[204] Another example of a complementary use of regulations and incentives might be to provide financial incentives to meet a regulated target.[205]

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197 Ibid.

198 ENVI, *Evidence*, 25 February 2014 (Gordon Walker); ENVI, *Evidence*, 4 March 2014 (Ian Wilcox).

199 Ibid. (Ian Wilcox).

200 Ibid.

201 ENVI, *Evidence*, 3 April 2014 (Theresa McClenaghan).

202 Ibid.

203 ENVI, *Evidence*, 4 March 2014 (Ian Wilcox).

204 Ibid.

205 ENVI, *Evidence*, 25 March 2014 (Don Pearson).

Best Practices in Management: Preventive, Adaptive and Holistic Management

A. Preventive and Adaptive Management

Perhaps the most simple and commonly cited "lesson learned" from 40 years of remediating water quality problems in the Great Lakes is that it is less expensive and more expedient to prevent pollution in the first place than to try to clean it up after the fact. As advised by one witness who testified about best practices in remediation: "First and foremost, don't pollute your environment is probably a good start."[206] Implicit in pollution prevention is adaptive management, which means constantly evaluating and improving the efficacy of a management approach in response to changing conditions or other factors.[207]

While the days of lax regulation and disposing of pollutants directly into rivers and lakes are gone, opportunities abound to prevent further pollution to Great Lakes' waters through adaptive management. Witnesses identified four issues for which planners and authorities need to be preparing in order to prevent further and large-scale degradation of Great Lakes water quality.

The first issue is future population growth. As mentioned earlier, over 80% of Ontario's population growth — a projected increase of 3.7 million people — is expected to occur in the Golden Horseshoe area around Lake Ontario between now and 2031.[208] The further urbanization of this area and other areas within the Great Lakes Basin will result in more potential sources of pollution as well as loss of natural ground cover to paved and other hard surfaces through which water cannot infiltrate.[209]

On a global scale, the Earth's population is expected to grow to 8 billion people by 2030 and to 9 billion people by 2050.[210] One witness warned that Canada, being one of the world's leading exporters of agricultural products, will be expected literally to "feed… the world — produce… goods and services that other countries have difficulty producing because they don't have the benefit of these water resources — [which] is likely to be the larger pressure and opportunity or benefit for Canada in terms of population increase."[211]

Several witnesses discussed the need to "develop preventative measures before the stresses to the Great Lakes [due to population growth] manifest."[212] They called on authorities to be proactive rather than reactive, which "makes sense; it's less

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206 ENVI, *Evidence*, 27 February 2014 (Chris Murray).

207 ENVI, *Evidence*, 3 April 2014 (Bernadette Conant, Executive Director, Canadian Water Network).

208 ENVI, *Evidence*, 8 April 2014 (Conrad deBarros).

209 Ibid.

210 ENVI, *Evidence*, 3 April 2014 (Bernadette Conant).

211 Ibid.

212 ENVI, *Evidence*, 8 April 2014 (Conrad deBarros).

expensive."[213] The correlative of this requirement is an opportunity for Ontario and Canada to take advantage of the Great Lakes water resources to feed the world's growing population, which requires careful planning to carry out in a sustainable manner.[214]

A second issue witnesses identified as requiring preventive and adaptive management is the threat posed by the possible introduction of new invasive species.[215] Trying to control invasive species once they make their way into the Great Lakes system is an expensive proposition at best. For example, a representative from Fisheries and Oceans Canada testified that that Department has been collaborating with the United States through the Great Lakes Fishery Commission for more than 50 years to deliver "the world's largest ongoing invasive species control program suppressing sea lamprey in the Great Lakes," which is needed to protect fisheries valued at $1.2 billion.[216] Although the program "comes at a considerable cost,"[217] it is regarded as successful because it has resulted in a 90% reduction in the sea lamprey population since the early 1960s.[218] Not all invasive species can be controlled at any cost, however.[219]

Another, more recent invasive species that has taken root in the Great Lakes Basin is phragmites, or common reed, which is an aggressive perennial grass. One witness described phragmites as turning "wetlands into monocultures where they don't function effectively as a habitat or from a water quality or a flood control standpoint."[220]

As mentioned previously, zebra and quagga mussels are posing significant problems in the Great Lakes. Monitoring in Lake Ontario in 2008 showed an estimated 9.7 trillion of such dreissenid mussels in the nearshore areas of the lake, with "the ability to filter the volume of the nearshore water in roughly one to seven days."[221] Currently, there is no management strategy to deal with these mussels.[222]

While it is too late to prevent the introduction of sea lamprey, phragmites and zebra and quagga mussels to the Great Lakes system, there is still time to take measures to prevent other invasive species, such as Asian carp, from reaching the lakes. Numerous

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213 Ibid.

214 ENVI, *Evidence*, 3 April 2014 (Bernadette Conant).

215 Note the recent House of Commons Standing Committee on Fisheries and Oceans report entitled *Invasive Species that Pose a Threat to the Great Lakes System*, which was tabled in April 2013.

216 ENVI, *Evidence*, 13 February 2014 (David Burden).

217 Ibid.

218 ENVI, *Evidence*, 25 February 2014 (Robert Lambe).

219 ENVI, *Evidence*, 27 March 2014 (William Taylor).

220 ENVI, *Evidence*, 27 February 2014 (David Ullrich).

221 ENVI, *Evidence*, 8 April 2014 (Conrad deBarros).

222 ENVI, *Evidence*, 27 March 2014 (William Taylor).

witnesses characterized Asian carp as posing an extremely serious threat to the ecology of the Great Lakes.[223]

Since Asian carp are approaching the Great Lakes system from the Mississippi Basin in the south, the United States has a primary responsibility to prevent the introduction.[224] However, Canada's interests are also at stake in preventing these fish from entering the Great Lakes, and Canada should continue to be involved in preventing their introduction. A representative from Fisheries and Oceans Canada told the Committee that the department is "currently drafting national aquatic invasive species regulations, with a goal of preventing the introduction and establishment of high-risk aquatic invasive species."[225] Further, the Committee learned that a new Asian carp research lab will soon be opening at the Canada Centre for Inland Waters.[226]

A third issue some witnesses discussed as requiring preventive and adaptive management is new toxic chemicals being found in the Great Lakes. The Committee heard that under the chemical management plan, Environment Canada is "constantly assessing new chemicals and trying to prevent the release of harmful chemicals into the environment."[227] Yet, certain toxic chemicals are still finding their way into the Great Lakes system. For example, mercury levels in the Great Lakes "are holding steady."[228] A significant source of the mercury is air deposition from coal-fired thermal power plants in the United States, "and a measurable source is from China."[229]

Other harmful chemicals in the Great Lakes are coming from local sources. Witnesses testified about the feminization of fish as a result of environmental estrogen exposure at some contaminated sites, such as the St. Clair River. Evidence of such an effect is that egg yolk proteins, typical of female fish, are found in male fish blood that has been exposed to environmental estrogens coming from industrial sites and from residential waste water treatment plants.[230] Various witnesses listed additional chemicals being found in the lakes, including brominated flame retardants, perfluorinated acids, antidepressants, antibiotics, and endocrine-disrupting substances.[231]

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223 ENVI, *Evidence*, 1 April 2014 (Jan Ciborowski); ENVI, *Evidence*, 8 April 2014 (Nancy Goucher).

224 The Committee heard testimony about work being done by the United States Army Corps of Engineers to identify options for keeping Asian carp out of the Great Lakes, including permanently separating the Great Lakes and Mississippi basins. See ENVI, *Evidence*, 8 April 2014 (Nancy Goucher).

225 ENVI, *Evidence*, 13 February 2014 (David Burden).

226 ENVI, *Evidence*, 8 April 2014 (Nancy Goucher).

227 ENVI, *Evidence*, 13 February 2014 (Michael Goffin).

228 ENVI, *Evidence*, 3 April 2014 (Jules Blais).

229 ENVI, *Evidence*, 27 March 2014 (James Bruce).

230 ENVI, *Evidence*, 3 April 2014 (Jules Blais).

231 Ibid.

Several witnesses recommended the adoption of a more preventive approach to keep chemicals such as those listed above out of the Great Lakes.[232] They testified that current efforts to reduce the release of such chemicals should be increased.[233]

The fourth and final issue that witnesses raised as requiring preventive and adaptive management is climate change. Climate change is affecting wildlife species, both native and invasive, as well as human uses of the water, including for drinking, fishing, shipping and recreation.[234] Further, climate change is frustrating current efforts to improve water quality in the Great Lakes.[235]

Witnesses called both for mitigation and adaptation to climate change. In terms of mitigation, reducing greenhouse gas emissions will require further commitments — not just from all levels of government, but on a global scale as well.[236] Adaptation is necessarily a more local goal.

Adapting to climate change involves multiple facets. For example, as one witness explained, "in warmer temperatures certain fish species will not be able to spawn and will die out. We need to be ahead of the game and looking out for those fish interests."[237] He suggested looking to the United States and learning from their habitat management practices, "because their temperatures today will be Canada's temperatures tomorrow."[238]

Another witness suggested that there is a need to develop the ability to retain water in Lake Huron — the only Canadian Great Lake for which there currently is no such ability — in order to better manage impacts of climate change.[239] As well, agricultural practices will have to adjust to changing weather patterns,[240] and communities and cities will need to build resilience to changing conditions.[241] Specifically, one witness called on the federal government to support communities in dealing with the increased flooding and droughts associated with climate change.[242]

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232 ENVI, *Evidence*, 27 March 2014 (James Bruce).

233 ENVI, *Evidence*, 3 April 2014 (Theresa McClenaghan).

234 ENVI, *Evidence*, 1 April 2014 (David Sweetnam); ENVI, *Evidence*, 8 April 2014 (Nancy Goucher); ENVI, *Evidence*, 25 February 2014 (Gordon Walker).

235 ENVI, *Evidence*, 25 March 2014 (Don Pearson).

236 ENVI, *Evidence*, 25 February 2014 (Gordon Walker); ENVI, *Evidence*, 8 April 2014 (Nancy Goucher).

237 ENVI, *Evidence*, 25 February 2014 (Jim Ransom, Director, Tehotiiennawakon, Mohawk Council of Akwesasne, and Representative, Chiefs of Ontario).

238 Ibid.

239 ENVI, *Evidence*, 1 April 2014 (Mary Muter).

240 Don Pearson, Lower Thames Valley Conservation Authority, written brief, 25 March 2014.

241 ENVI, *Evidence*, 8 April 2014 (Nancy Goucher).

242 Ibid.

More broadly, as stated by one witness: “every decision we make in terms of water will need to consider what will be happening in terms of climate change.”[243]

B. A Holistic Management Approach

In addition to the need to manage Great Lakes water quality in a preventive and adaptive manner, numerous witnesses throughout the study testified that it is difficult to manage water quality issues in isolation. They suggested that, beyond controlling point sources and pollution hotspots, the complex nature of the remaining water quality problems requires management at a more systemic, or holistic level.[244]

A good example of the need for holistic management centres on the phosphorus problem. Total phosphorus inputs have been reduced since the 1970s and, for a number of years, algal bloom problems were under control if not completely solved. But algal blooms have returned despite continued lower average inputs because of the influence of new agricultural practices, the presence of invasive mussels, low water levels and population growth.

The Great Lakes Basin is a “working, developed landscape”[245] supporting diverse human activities that can affect water quality in interrelated ways. As a result, numerous witnesses pointed to a need to manage human activities in the basin as a whole. As expressed by one witness:

> What we really need to do is start managing the Great Lakes as ecosystems and manage them more holistically, including managing the fishery as well as the water quality at the same time, and the land use. It really takes a much more complex approach to the problem than just more or less phosphorus than what we are currently allowing in.[246]

Complicating matters is the fact that the Great Lakes straddle the international border, implicating two national governments in their management. There are institutions in place to facilitate binational cooperation in Great Lakes’ management, but witnesses noted that the mandates of these institutions are not broad enough to enable them to facilitate the management of fisheries, water quality and other water issues in an integrated manner. One witness suggested that the Great Lakes Fishery Commission and the International Joint Commission, binational organizations mandated with fisheries management and water quality management respectively, should work more closely together.[247] In addition, it was noted that the importance of these two institutions should be

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243 Ibid.

244 ENVI, *Evidence*, 3 April 2014 (Bernadette Conant).

245 Ibid.

246 ENVI, *Evidence*, 27 March 2014 (William Taylor).

247 Ibid.

recognized by the Canadian government fully funding the fishery commission[248] and appointing a third Canadian commissioner to the International Joint Commission.[249]

248 ENVI, *Evidence*, 25 February 2014 (Robert Lambe).

249 Ibid.

THE BASIS OF BEST PRACTICES: SCIENTIFIC KNOWLEDGE

Scientific knowledge and expertise is fundamental to all best practices to remediate or protect water quality, in local or holistic contexts. Such expertise is needed to define problems, identify remediation options, monitor results of remediation efforts and plan for future developments. As the Committee heard, governments are a source of much of this knowledge and expertise.

The need for scientific knowledge and expertise was driven home in much of the testimony. Regarding the development and implementation of remedial action plans, for instance, one witness noted:

> We couldn't have moved forward without that scientific expertise [of the federal government]. We couldn't have even begun the task. … The one thing, when it comes to recommendations to this committee, that I can't stress enough is the importance of that scientific base, which needs to continue to be there. And it needs to be throughout the Great Lakes system, so that they're not just looking at the Hamilton harbours and the Torontos, but at the other, smaller [areas of concern].[250]

Understanding the effectiveness of remedial actions also requires research. In some cases, witnesses felt that this research is lacking. As expressed by one witness, "some of this basic science data [on the effects of wetland remediation on fish habitat and coastal water quality] is missing, mostly on the Canadian side. There are various ways to get this information, including remote sensing technologies such as light radar, but this requires the resources of the federal government, and not just for today but to inform Canadian decisions in the coming centuries."[251] Other witnesses suggested that there is a lack of funding for basic research into measuring success because limited research dollars get concentrated in studying restoration.[252]

Monitoring is an important component of scientific knowledge that was stressed many times throughout the Committee's study. A number of witnesses felt that monitoring is largely the obligation of governments at all levels,[253] since monitoring needs to be long term and it needs to be continuous to be most useful.[254]

Knowledge and information about what changes may come in the future is also important. For instance, one witness mentioned the need for access to information on

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250 ENVI, *Evidence*, 27 February 2014 (John Hall).

251 ENVI, *Evidence*, 1 April 2014 (David Sweetnam).

252 Ibid. (Jan Ciborowski).

253 ENVI, *Evidence*, 27 March 2014 (James Bruce).

254 ENVI, *Evidence*, 1 April 2014 (Jan Ciborowski).

population growth scenarios and climate change predictions to "demonstrate what we need to manage and adapt to. Watershed and shoreline managers need to be able to access climate change data and information specific to the Great Lakes region, and that is not something we can do locally."[255]

The federal government is already involved in both conducting and funding scientific research. Various federal research initiatives relevant to Great Lakes water quality were mentioned during testimony. In particular, the 2012 federal investment of $16 million into the Great Lakes Nutrient Initiative "is being directed to research and monitoring to better understand the causes of toxic and nuisance algae growth, and to provide data and information necessary to establish new phosphorus reduction targets."[256] A witness noted that monitoring under this program "along the north shore of Lake Erie and in the Thames River will complement existing and more intensive monitoring efforts in the Ontario Grand River."[257]

A representative from Agriculture and Agri-Food Canada also noted that department's programs to "investigat[e] strategies to manage nitrogen, phosphorus, and manure in pursuit of improved agricultural practices that improve crop nutrient utilization and reduce losses to the surrounding ecosystem."[258]

Clearly, scientific research and expertise is needed in all aspects of improving and maintaining water quality throughout the Great Lakes Basin.

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255 ENVI, *Evidence*, 25 March 2014 (Bonnie Fox).

256 ENVI, *Evidence*, 13 February 2014 (Chris Forbes).

257 ENVI, *Evidence*, 25 February 2014 (Gordon Walker).

258 ENVI, *Evidence*, 13 February 2014 (Ian Campbell).

CONCLUSION

While the focus of the Committee's study was on best practices, the ever-changing environment means that best practices are not static. Populations, agricultural and industrial practices as well as climate, all may change, and new threats to water quality arise. So perhaps the best practice of all for addressing water quality issues is that described by Conrad deBarros:

> The final best management practice is eternal vigilance. We need to keep it up. … We need to keep the safeguards to ensure that we're not backsliding on the amount of investments that we've made over the years. We need to be aware that the lakes are changing. The climate is changing. There are new threats. We need to deal with them and adapt.[259]

The 2012 *Great Lakes Water Quality Agreement* forms the basis upon which the axiom of "eternal vigilance" must begin to be applied. Many people are investing much hope in the signing of this agreement, with the expectation that "robust funding"[260] for its implementation will be provided. Considering the billions of dollars that have been spent to remediate water quality to this point, and the valuable interests that this investment is protecting, we need to keep up the interest and the momentum. As one witness stated, "we can't just walk away."[261]

259 ENVI, *Evidence*, 8 April 2014 (Conrad deBarros).

260 ENVI, *Evidence*, 1 April 2014 (David Sweetnam).

261 ENVI, *Evidence*, 25 March 2014 (Terry Murphy).

RECOMMENDATIONS

RECOMMENDATION 1

The Committee recommends that all levels of government continue to work together to share information on best practices to ensure that we all have the best resources and research to address water quality in our Great Lakes.

RECOMMENDATION 2

The Committee recommends that the federal government continue to support remediation with the goal of delisting the Great Lakes Areas of Concern.

RECOMMENDATION 3

The Committee recommends that the federal government continue to take action to prevent Asian carp from entering our Great Lakes.

RECOMMENDATION 4

The Committee recommends that the federal government continue to support scientific research to improve our understanding of Great Lakes water quality issues.

RECOMMENDATION 5

The Committee recommends that the federal government consider ways to conserve and remediate rural and urban wetlands in the Great Lakes watershed which will improve water quality, mitigate flooding, and conserve biodiversity.

RECOMMENDATION 6

The Committee recommends that the federal government continue to actively participate in the *Great Lakes Water Quality Agreement* and the International Joint Commission and continue to support them in working toward their objectives.

RECOMMENDATION 7

The Committee recommends that the federal government continue to encourage mitigation and adaptation measures to address Great Lakes water quality challenges by working with municipalities, provinces, territories, First Nations and other groups, to monitor and improve water quality in the Great Lakes.

RECOMMENDATION 8

The Committee recommends that the federal government consider ways to address non-point source pollution in the Great Lakes watershed in collaboration with all levels of government, industry, and stakeholders, especially the agricultural community.

RECOMMENDATION 9

The Committee recommends that the federal government manage the Great Lakes as an ecosystem in a more holistic way.

APPENDIX A
LIST OF WITNESSES

Organizations and Individuals	Date	Meeting
Department of Agriculture and Agri-Food	2014/02/13	12
Ian D. Campbell, Director, Science Coordination Division, Science and Technology Branch		
Department of Fisheries and Oceans		
David Burden, Acting Regional Director General		
Patrice Simon, Director, Environment and Biodiversity Science		
Trevor Swerdfager, Assistant Deputy Minister, Ecosystems and Fisheries Management - Operations		
Department of the Environment		
Patricia Chambers, Section Head, Watershed Stressors and Nutrients, Science and Technology Branch		
Chris Forbes, Assistant Deputy Minister, Strategic Policy Branch and Regional Directors General Offices		
Michael Goffin, Regional Director General, Ontario Region		
Infrastructure Canada		
Jeff Moore, Assistant Deputy Minister, Policy and Communications		
Stephanie Tanton, Director, Priority Initiatives, Policy and Communications		
Chiefs of Ontario	2014/02/25	13
Chief April Adams-Phillips, Representative, Mohawk Council of Akwesasne		
Jim Ransom, Representative, Director, Tehotiiennawakon, Mohawk Council of Akwesasne		
Grand River Conservation Authority		
Joe Farwell, Chief Administrative Officer		
Great Lakes Fishery Commission		
Robert Lambe, Executive Secretary		
International Joint Commission		
Gordon W. Walker, Acting Chair, Canadian Section		
City of Hamilton	2014/02/27	14
John Hall, Coordinator, Hamilton Harbour Remedial Action Plan		
Chris Murray, City Manager		
City of Toronto		
Michael D'Andrea, Executive Director, Engineering and Construction Services		

Organizations and Individuals	Date	Meeting
Great Lakes and St. Lawrence Cities Initiative	2014/02/27	14
David A. Ullrich, Executive Director		
Government of Ontario	2014/03/04	15
Maurice Bitran, Assistant Deputy Minister, Ministry of the Environment, Integrated Environmental Policy Division		
Brian Nixon, Director, Ministry of the Environment, Integrated Environmental Policy Division		
Jim Richardson, Director, Ministry of Agriculture & Food, Environmental Management Branch		
Upper Thames River Conservation Authority		
Ian Wilcox, General Manager and Secretary Treasurer		
Conservation Ontario	2014/03/25	17
Bonnie Fox, Manager, Policy and Planning		
Lower Thames Valley Conservation Authority		
Donald Pearson, General Manager		
Quinte Conservation Authority		
Terry Murphy, General Manager and Secretary Treasurer		
As an individual	2014/03/27	18
Patricia Chow-Fraser, Professor, Director of Life Sciences Program, McMaster University, Department of Biology		
Forum for Leadership on Water		
James Bruce, Representative		
St. Lawrence River Institute of Environmental Sciences		
Jeff Ridal, Executive Director		
University of Waterloo		
William Taylor, Professor Emeritus, Biology		
As an individual	2014/04/01	19
Jan Ciborowski, Professor, University of Windsor		
Ducks Unlimited Canada		
James Brennan, Director		
Mark Gloutney, Director, Regional Operations, Eastern Region Government Affairs		
Georgian Bay Forever		
David Sweetnam, Executive Director		
Sierra Club of Canada		
Mary Muter, Vice Chair, Restore Our Water International		
As an individual	2014/04/03	20
Jules Blais, Professor, University of Ottawa		

Organizations and Individuals	Date	Meeting
Canadian Environmental Law Association	2014/04/03	20
Fe de Leon, Researcher		
Theresa McClenaghan, Executive Director and Counsel		
Canadian Water Network		
Bernadette Conant, Executive Director		
Manitoulin Area Stewardship Council		
Robert Florean, Council Member and Technical Advisor		
Bay Area Restoration Council	2014/04/08	21
Chris McLaughlin, Executive Director		
Environmental Defence Canada		
Nancy Goucher, Program Manager		
Toronto and Region Conservation Authority		
Conrad deBarros, Project Manager, Toronto and Region Remedial Action Plan, Watershed Management		

APPENDIX B
LIST OF BRIEFS

Organizations and Individuals

Canadian Water Network

Chiefs of Ontario

Chow-Fraser, Patricia

Ciborowski, Jan

Great Lakes Fishery Commission

International Joint Commission

REQUEST FOR GOVERNMENT RESPONSE

Pursuant to Standing Order 109, the Committee requests that the government table a comprehensive response to this Report.

A copy of the relevant *Minutes of Proceedings* (Meetings Nos. 12, 13, 14, 15, 17, 18, 19, 20, 21, 22 and 23) is tabled.

Respectfully submitted,

Harold Albrecht

Chair

DISSENTING REPORT FROM THE OFFICIAL OPPOSITION NEW DEMOCRATIC PARTY ON THE STUDY OF GREAT LAKES WATER QUALITY

The New Democratic Party of Canada would like to thank all who appeared before or submitted written briefs to the Standing Committee on Environment and Sustainable Development during the Committee's study of water quality in the Great Lakes.

While we agree with some of the basic points in the Committee Report, there are significant areas where we have concerns. Unfortunately, given an imposed page restriction, we are only able to articulate some of those in this report.

One key shortcoming of the report is its failure to make any recommendations regarding the impacts of climate change on the Great Lakes ecosystem.

Prior to the initiation of the study, the New Democrats introduced motions to explicitly include climate change in the mandate to ensure that these significant impacts were not exempted from the study, but the majority of the Committee members were not convinced.

During testimony, in fact, climate change was raised as one of the most significant factors affecting water quality in the Great Lakes on dozens of occasions.

Ms. Nancy Goucher of Environmental Defense Canada pointed to the effects of warming temperatures and more intense rainfalls on the increase of algae growth, especially in Lake Erie.

``You're going to have warmer waters and more intense rainfall events, and both are going to lead to an increase in algae growth, especially in Lake Erie. Also, with warmer waters and warmer winters, you're going to have less ice cover, which leads to more evaporation, which in turn leads to lower lake levels…In terms of solutions, I would say that we really need to be looking at both mitigation and adaptation. In terms of adaptation, conservation authorities and other partners on the ground have been doing a great job in working toward ways to build more resilient cities and resilient communities.

In terms of a federal role, I think there's a direct federal role for the federal government: to support communities in helping them deal with flooding and droughts, in funding infrastructure upgrades and emergency planning, and in renewing the flood damage reduction program so that we're not building in flood plains.

Also, I think we need to be looking at mainstreaming our water policies with climate change. Every decision we make in terms of water will need to consider what will be happening in terms of climate change.

On top of this, we need to be looking at mitigation. At a provincial and even a municipal level, I think we have a lot of communities working on reducing greenhouse gas emissions. We need a stronger federal commitment in that capacity as well."

Mr. David Sweetnam, Executive Director of Georgian Bay Forever also weighed in.

"The effects of climate change are widespread and consequential. Fast-acting institutions, elastic regulations, and early-warning systems are needed as part of an adaptive management process to address these changes.

But according to the United Nation's climate change report released yesterday the scale of climate-change harms are expected to be so overwhelming that mitigation measures will be necessary to avert the greatest risks. In response to the report, Secretary of State John Kerry said, "Unless we act dramatically and quickly, science tells us our climate and our way of life are literally in jeopardy."

This is a warning and a significant call to action.

The environmental side effects of climate change —from water quality to invasive species, water levels and habitat erosion—are alarming. But the associated economic impacts could be in the billions, with major harms caused to tourism, property values, shipping, and other key industries. More research into these economic impacts is necessary, but the environmental harms are already clear."

Dr. Patricia Chow-Fraser of McMaster University warned that climate change is affecting water levels and temperatures, which affect water quality. "One of the many consequences of global climate change is there are lower than normal water levels in the Great Lakes, and we are seeing this now…There are many consequences of this, but the sustained low water levels have had immediate and devastating effects on the quantity and the quality of the fish habitat in coastal wetlands. Some of these negative effects have included up to 24% loss in breeding and nursery habitat, because they are no longer accessible to migratory fish. There is deterioration in the habitat structure related to disappearance of some of the submergent vegetation in the deeper water and a reduction in the species richness of fish and plant communities. If water levels were to drop to 174 metres, which is predicted by the global circulation models, access to another 50% of the wetlands now extant will be lost.

Even if wetlands don't dry up, we are also concerned about the thermal quality of these wetlands. We have monitored the water temperatures in some of these embayments and have found that the temperature of the water that is used by pike is approaching 27.5°C, which is the point at which the fish stop feeding. We know when they don't feed, they're not growing and they start to die.

There is very little information on how water temperature in these nearshore habitats is changing. There is not a single monitoring system in the whole of eastern and northern Georgian Bay that is now being monitored by government. This highlights the need for more targeted research to understand the threat of warming temperatures and low water levels on the health of nearshore embayments."

Concerns about climate change and its impact on the Great Lakes were not limited to academics and community groups. Provincial government representatives also made the link.

Dr. Maurice Bitran, Assistant Deputy Minister in the Ministry of the Environment, Integrated Environmental Policy Division, for the Government of Ontario, stressed the importance of the Great Lakes to the province of Ontario, and the risks associated with climate change.

"The Great Lakes are of great importance to the province of Ontario. The Great Lakes are the source of drinking water for 80% of Ontarians, and the Great Lakes basin is where the

great majority of Ontarians live and where most of our economic, agricultural, and social activities take place…

The changing climate has emerged as a significant threat to Great Lakes water quality. For example, severe weather events associated with climate change have increased runoff to the Great Lakes, and with it the flow of pollutants from urban, industrial, and agricultural sources.

In order to improve our understanding of stressors such as climate change and enhance our ability to adapt, Ontario is increasing public access to scientific information on the Great Lakes and enhancing monitoring and modelling to understand and predict the impacts of climate change and other cumulative impacts.Mr. Jim Richardson, a Director at the Ministry of Agriculture & Food, Environmental Management Branch of the Government of Ontario detailed gaps in existing knowledge, and the need for research to both protect the environment and to help the agricultural community.

“There is much that we don't know about the interaction between human activities and the ecosystem of the Great Lakes basin, and how this is being further complicated by climate change, invasive species, and other factors.

The ministry's best practices verification and demonstration program endeavours to examine some of these challenges from an environmental and economic perspective by field testing new and improved practices to address such challenges as extreme weather events. It is through these research programs and working with our federal and U.S. colleagues that we are developing a better understanding of what actions we can take to support the health of the Great Lakes basin ecosystem.

Some witnesses had to beg to address climate change. Mr. Michael D'Andrea, of the City of Toronto pleaded,

“Mr. Chair, if I could beg your indulgence for just one minute, I need to recognize the fact that I know there was an interest in talking about climate change adaptation strategies in the City of Toronto to deal with urban flooding as well as the work we've done for source water protection in the near-shore area of Lake Ontario”

Mr. Gordon W. Walker, the Acting Chair of the Canadian Section of the International Joint Commission made some compelling statements.

“Climate change is huge for all of us, and none of us in this room could likely say that they haven't seen the impact of climate change, such as more moderate winters, although I can't say that about right now. We've had a pretty impressive winter, and just two weeks ago 90% of the surface of the Great Lakes was covered by ice. That is the first time that has happened since 1994, but if I'd been here in any year in between, I would have been bemoaning the fact that there was not enough ice cover and that the evaporation was so phenomenal that it was taking away huge amounts of water and causing great impact on the Great Lakes.

How to stop climate change is something that scientists have been arguing for a long time, and of course, there are hundreds of arguments out there on how to stop climate change. I'm not sure I can add much to that equation, but very obviously, if climate change can somehow or another be slowed or reversed, then that would have a huge impact on the

Great Lakes and a great impact on all of us. Stretching from the point where Lake Superior is at one end all the way to the Gulf of St. Lawrence, it has huge impact on the water, both in terms of quantity and in terms of what flows from that.

When there is a lower quantity of water caused by climate change, that presents a problem. That makes trouble for shipping. That makes trouble for fishing. It makes trouble for the quality of the water, so anything that can stop, discourage, or reverse climate change is important. It may be a pretty tough order to accomplish. It's going to take the entire world being part of that."

It was clear throughout the study that climate change plays an enormous and obvious detrimental role affecting the water quality of the Great Lakes ecosystem, and on the drinking water of millions of Canadians and US residents. To ignore that risk, and to deny the impacts is not only risky, it is irresponsible.

New Democrats believe that immediate, aggressive action is needed by Canada to address, mitigate, and ultimately assist Canadians and municipal and provincial governments adapt to the effects of climate change. It is not a theoretical risk that might be faced by future generations, it is an immediate and urgent problem.

This government has exhibited an overall lack of respect for and recognition of the importance of the contributions of science and scientists, and of environmental groups, Aboriginal groups, and communities. All of these stakeholders must be included in developing a national plan to address climate change, and to address the issue of water quality in the Great Lakes.

LIBERAL PARTY MINORITY REPORT

It is remarkable that a Standing Committee on the Environment and Sustainable Development can undertake a study on the water quality of the Great Lakes Basin and yet never mention climate change or water quantity issues in its list of recommendations. The body of the Report regularly references the deleterious impact climate change is having on both the Great Lakes and ongoing efforts to remediate chronic environmental issues, but no recommendations deal with this important aspect. Furthermore, the Report regularly references lower water levels, but again, no recommendations deal with this issue either – as if to suggest that you can divorce water quality from water quantity, the effects of climate change and the increasing frequency of extreme weather events. If you have a narrow, limited focus, you will end up with a narrow, limited and ultimately quite useless list of recommendations.

Below is the list of paragraphs referencing climate change contained within this Report (emphasis added):

(50) Problems related to non-point source pollution in the Great Lakes are complicated by the introduction of new invasive species that are changing the food web, by changes in land use and other human interventions as well as by climate change. One witness referred to these factors as "game changers."[1]

[1] Dr. Jeff Ridal, Executive Director, St. Lawrence River Institute of Environmental Sciences, written brief, 27 March 2014.

(58) Finally, climate change also appears to be exacerbating the situation. Warming weather causes more evaporation from the lakes, including during winter months if there is not enough ice cover.[2] Increased evaporation leads to lower water levels, particularly in the shallow nearshore areas, which warm faster, promoting algal growth. In addition, more dissolved phosphorus is entering waterways as a result of "more runoff with increased frequency of heavy rain and snowmelt periods in the changing climate."[3]

(85) There appear to be multiple causes of sustained low water levels in Lake Huron, along with Lake Michigan, which are lobes of the same lake. One cause is dredging of the St. Clair River in the 1950s and 1960s, and subsequent erosion in the same area, which has resulted in water flowing out of the system at a greater rate. Another cause of low water levels that a number of witnesses pointed to is climate change. Climate change is linked to increased runoff as a result of more frequent extreme storms,[4] but also has been causing less ice cover in winter, which increases evaporation and lowers water levels.

(90) The Great Lakes, however, are a dynamic system subject and reacting to change. The resurgence of algal blooms, despite continued lower phosphorus inputs, points to new forces that must be taken into account in planning remediation efforts. Non-point sources of phosphorus and other pollutants are now of significant concern. The Great Lakes system's response to these inputs is complicated by

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2 ENVI (27 March 2014) (Bruce).

3 Ibid.

4 ENVI (8 April 2014) (Ms. Nancy Goucher, Program Manager, Environmental Defence Canada).

other changes occurring in the system resulting from invasive species, climate change and the influence of a growing population in the region.

(101) However, some initiatives are underway to facilitate sharing best practices. The Great Lakes and St. Lawrence Cities Initiative has a website devoted to best practices as well as a similar Municipal Adaptation and Resiliency Service targeted at climate change adaptation techniques.

(131) The fourth and final issue that witnesses raised as requiring preventive and adaptive management is climate change. Climate change is affecting wildlife species, both native and invasive, as well as human uses of the water, including for drinking, fishing, shipping and recreation. Further, climate change is frustrating current efforts to improve water quality in the Great Lakes.

(132) Witnesses called both for mitigation and adaptation to climate change. In terms of mitigation, reducing greenhouse gas emissions will require further commitments not just from all levels of government, but on a global scale as well. Adaptation is necessarily a more local goal.

(133) Adapting to climate change involves multiple facets. For example, as one witness explained, "in warmer temperatures certain fish species will not be able to spawn and will die out. We need to be ahead of the game and looking out for those fish interests." He suggested looking to the United States and learning from their habitat management practices, "because their temperatures today will be Canada's temperatures tomorrow."

(134) Another witness suggested that there is a need to develop the ability to retain water in Lake Huron — the only Canadian Great Lake for which there

currently is no such ability — in order to better manage impacts of climate change. As well, agricultural practices will have to adjust to changing weather patterns, and communities and cities will need to build resilience to changing conditions. Specifically, one witness called on the federal government to support communities in dealing with the increased flooding and droughts associated with climate change.

(135) More broadly, as stated by one witness: "every decision we make in terms of water will need to consider what will be happening in terms of climate change."

(144) Knowledge and information about what changes may come in the future is also important. For instance one witness mentioned the need for access to information on population growth scenarios and climate change predictions to "demonstrate what we need to manage and adapt to. Watershed and shoreline managers need to be able to access climate change data and information specific to the Great Lakes region, and that is not something we can do locally."

Each paragraph is an indication of climate change as an aggravating factor in nearly every environmental issue plaguing the Great Lakes, from phosphorus leeching to low water levels to invasive species, all warning of the importance of adaptation and mitigation. For example, paragraph 135 is clear, *"every decision we make in terms of water will need to consider what will be happening in terms of climate change."* Furthermore, Paragraphs 132, 134 and 144 call for government action on climate change or better access to climate change data. Again, inexplicably, the list of recommendations contains no mention of climate change at all.

The Standing Committee called this study to identify water quality issues in the Great Lakes Watershed and to make recommendations to the Government on how to remedy them, but the 9 recommendations agreed upon by the Conservative majority call for no substantive or additional action.

Six of the recommendations call for the Government to “continue to” do what very little is being done currently; two call on the Government to “consider ways” to do things that were addressed directly by witnesses in their testimony and considered by the Committee; and the last recommendation utilizes the weakest language possible in recommending “that the federal government manage the Great Lakes as an ecosystem in a more holistic way.”

This study has made it clear that climate change is a serious aggravating factor hindering our ability to address the myriad issues facing the Great Lakes. The importance of the largest freshwater system on earth cannot be understated as over 30 million Canadians and Americans depend on the Great Lakes for drinking water. Despite the well-known impacts of climate change, the Government has recently cut Climate Change and Clean Air Programs by 70 percent (Report on Plans and Priorities, 2014-15). If we are to deal with the larger issue, we must admit that climate change is an exacerbating factor hindering our mitigation and adaptation efforts and seek to put forth recommendations that both reflect this and call the Government to action.

The Liberal Party calls on the Government to:

1- Restore funding to the Climate Change and Clean Air Program.

2- Work with international partners to enact a comprehensive climate change adaptation and mitigation plan.

3- Develop robust regulation to address invasive species issues in the Great Lakes.

4- Develop robust regulations to deal with the unacceptably high levels of phosphorous and other toxic chemicals in the Great Lakes.

5- Restore funding to the Experimental Lakes Program.

6- Strengthen and support the International Joint Commission to better equip them to deal with emerging climate change issues affecting their mandate.