Environment Canada Environnement Canada

Canada

State of the Great Lakes Coasts

Great Lakes St. Lawrence Cities Initiative Technical Workshop

Niagara Falls, Ontario

John Marsden

Regional Director General's Office - Ontario

June 16, 2011

Contents

- About Environment Canada
- About the Great Lakes
- Coastal Zone Definition and Benefits
- Coastal Concerns
- Stressors, State and Trends
- Phosphorus
- Watershed - coast connections
- Recent Workshops and Reports
- Coastal Opportunities

About Environment Canada

A resource of immense importance

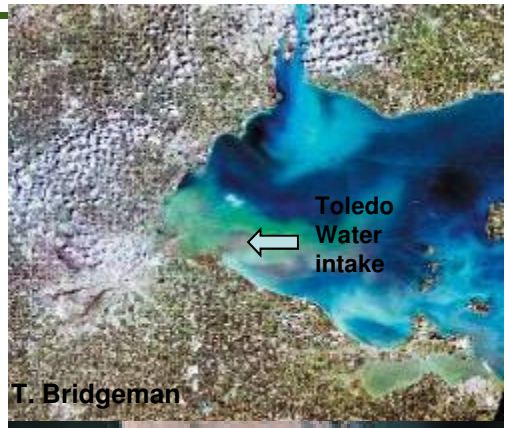
- One fifth of world's fresh surface water supply
- Support 279 globally rare plants, animals and natural communities
- Industries in the Great Lakes basin account for 1/3 of Canada-U.S. GNP
- 250 million tons of cargo shipped annually
- 40 million pounds of fish harvested annually; commercial and recreational fishing contribute $8.3 billion to region's economy
- $7 billion in tourism revenue
- Source of drinking water for one in four Canadians

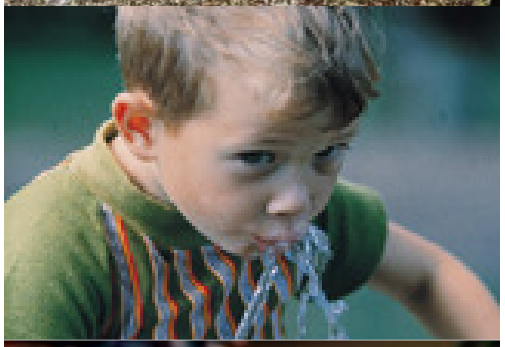
Great Lakes Coastal Zone

- Definition
- Benefits

Coastal Concerns

- **Human Health Concerns**
  - Drinking Water Quality
  - Groundwater Quality
  - Fish Consumption
  - Bacterial Contamination at beaches
  - Botulism outbreaks
  - Some harmful algal blooms produce toxins that if ingested cause liver damage in humans.
- **Fish and Wildlife Impacts**
  - Low Oxygen Levels in Lakes
  - Botulism outbreaks - numerous cases of animal poisonings
  - Impairments to fish and wildlife habitats
- **Socio-economic Impacts**
  - Recreation and Tourism (i.e. Beach Closures)
  - Commercial Fishing
  - Decreased Property Values
  - Water Intake Clogging at Power Utilities
  - Added costs for treating drinking water





State of the Great Lakes 2009

EPA

Canada

COASTAL ZONES and AQUATIC HABITATS

ID #	Indicator Name	2009 Assessment (Status, Trend)				
		Lake				
		SU	MI	HU	ER	ON
COASTAL ZONES						
Nearshore Aquatic						
4861	Effect of Alteration of Natural Water Level Fluctuations	?	?	?	?	⬅
8131	Extent of Hardened Shoreline	?				
Coastal Wetlands						
4501	Coastal Wetland Invertebrate Community Health	Progress Report				
4502	Coastal Wetland Fish Community Health	Progress Report				
4504	Coastal Wetland Amphibian Communities	?	⬅	⬅	◆	⬅
4506	Contaminants in Snapping Turtle Eggs	?	?	?	?	?
4507	Coastal Wetland Bird Communities	?	⬅	⬅	⬅	⬅
4510	Landscape Extent and Composition	?				
4861	Effect of Alteration of Natural Water Level Fluctuations	?	?	?	?	⬅
4862	Coastal Wetland Plant Communities	?	?	?	⬅	◆
4863	Land Cover Adjacent to Coastal Wetlands	Progress Report				
Terrestrial						
4861	Effect of Alteration of Natural Water Level Fluctuations	?	?	?	?	⬅
8129	Area, Quality and Protection of Special Lakeshore Communities - Alvars	?				
8129	Area, Quality and Protection of Special Lakeshore Communities - Cobble Beaches	?				
8129	Area, Quality and Protection of Special Lakeshore Communities - Islands	?	?	?	?	?
8129	Area, Quality and Protection of Special Lakeshore Communities - Sand Dunes	?	⬅	?	➡	➡
8131	Extent of Hardened Shoreline	?				
AQUATIC HABITATS						
Open Lake						
111	Phosphorus Concentrations and Loadings — open lake	◆	⬅	◆	◆	⬅
	Phosphorus Concentrations and Loadings — nearshore	?	?	?	?	?
118	Toxic Chemical Concentrations in Offshore Waters	?	?	?	?	?
119	Concentrations of Contaminants in Sediment Cores	?				
8131	Extent of Hardened Shoreline	?				
Groundwater						
7100	Natural Groundwater Quality and Human-Induced Changes	?				
7101	Groundwater and Land: Use and Intensity	?				
7102	Base Flow Due to Groundwate Discharge	?				
7103	Groundwater Dependent Plant and Animal Communities	?				

Status					Trend			
					➡	◆	⬅	?
Not Assessed	Good	Fair	Poor	Mixed	Improving	Unchanging	Deteriorating	Undetermined

Note: Progress Reports and some Reports from previous years have no assessment of Status or Trend.

Coastal Zones and Aquatic Habitats

- Special lakeshore communities and aquatic habitats are being adversely impacted by artificial alteration of water level fluctuation, shoreline hardening, development, and elevated phosphorous concentrations and loadings
- New data and management approaches indicate a potential for reversing the deteriorating conditions identified in some locations

Cobble Beaches

- Considered globally rare
- Lake Superior - 958 km
- Lake Huron - 483 km
- Lake Michigan - 164 km
- Lake Erie - 24 km
- Lake Ontario - 35 km

Home to a variety species of species (including 16 rare plant species), and serves as seasonal spawning and migration areas for fish and nesting birds

Decreasing due to shoreline development.

Alvars

Open habitats occurring on flat limestone bedrock, with a distinctive set of plant species.

90% destroyed or substantially degraded

28,000 acres remain, two-thirds within one km of shore

Sand Dunes

Approximately 22,000 acres in Ontario.

Difficult to assess the overall loss or status. Indications are a continued loss due to development, sand mining, recreational trampling, and non-indigenous invasive species.

Protection, restoration and sound management is possible, as demonstrated by many local success stories.

Islands

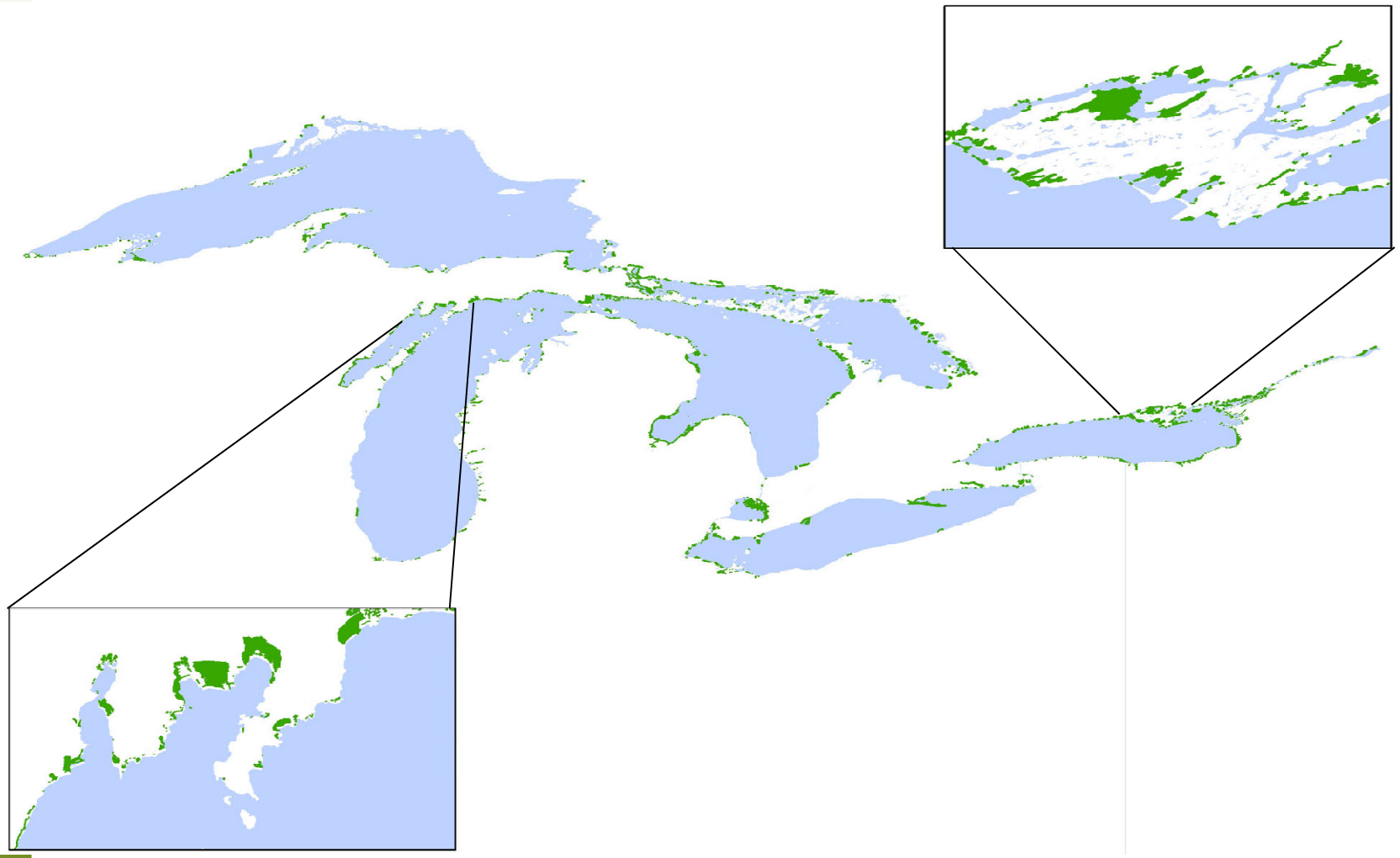
31,407 islands, with total coastline of 15,623 km

Some islands represent the most remote wilderness in the basin.

Important fish spawning habitat, and home to over 320 provincially rare species, including 27 globally rare species.

Development proposals are increasing. Also threatened by invasive species, climate change and pollution.

Coastal Wetlands



Coastal Wetlands - Amphibians

Trends of eight species assessed from 1995 to 2007.

Four species exhibit a significant negative population trend.

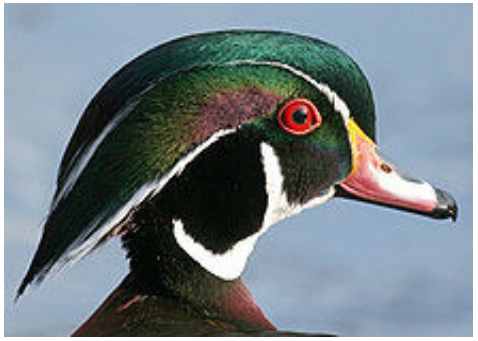



One species exhibits a significant positive population trend

Coastal Wetlands – Birds

56 bird species using marshes recorded from 1995 to 2007

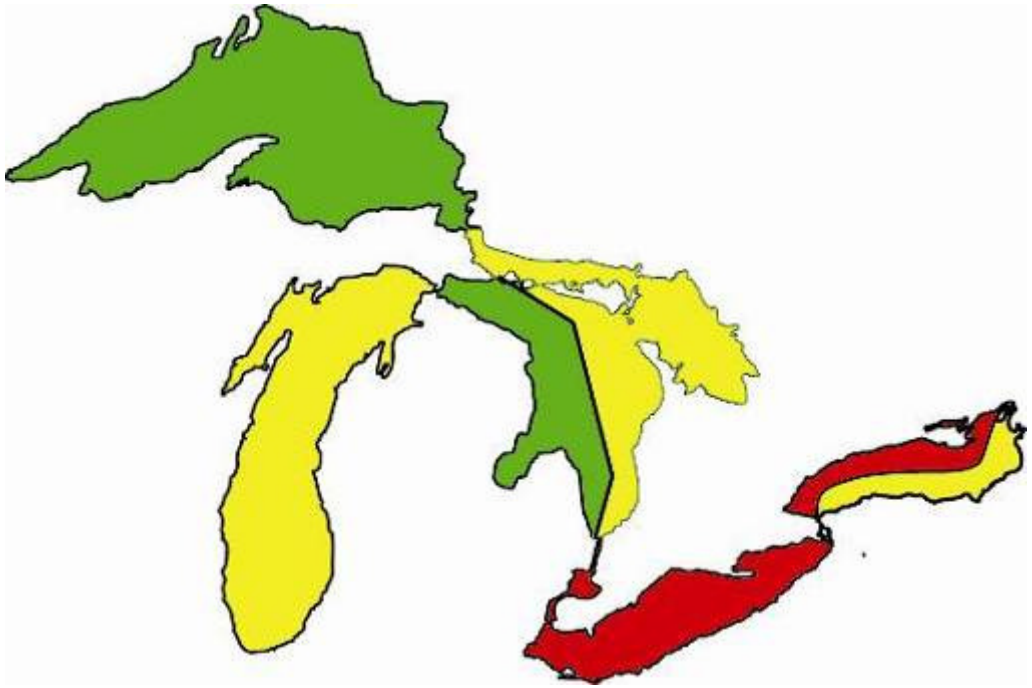
18 species have a significant negative population trend



6 species have a significantly positive population trend

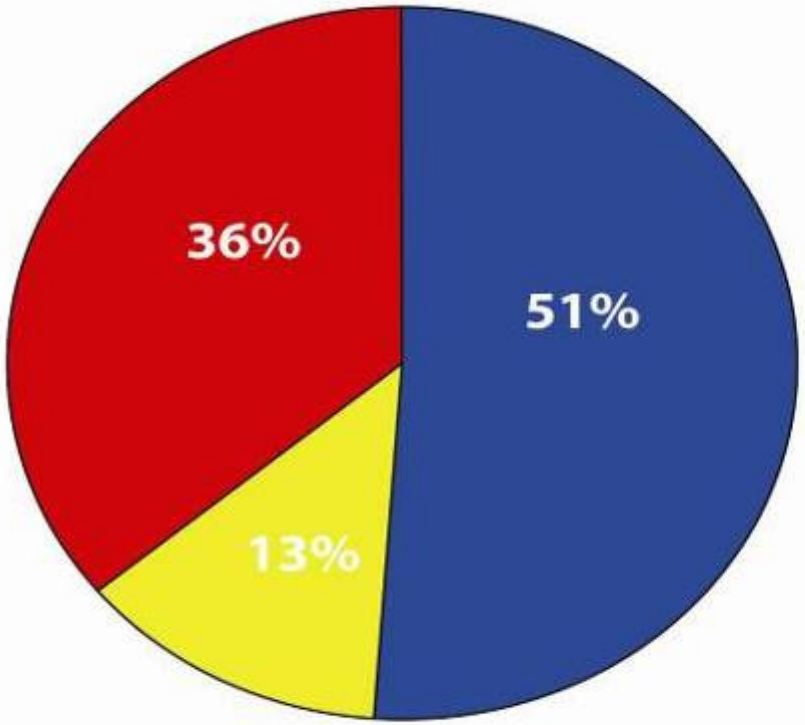
Great Lakes Recreational Beach Postings and Closures for 2007

The presence of *E. Coli* and other bacteria at swimming beaches continues to be a risk to human health



Good | Fair | Poor

Recreational Beach Postings and Closures - 2007 Canadian Great Lakes Swimming Season



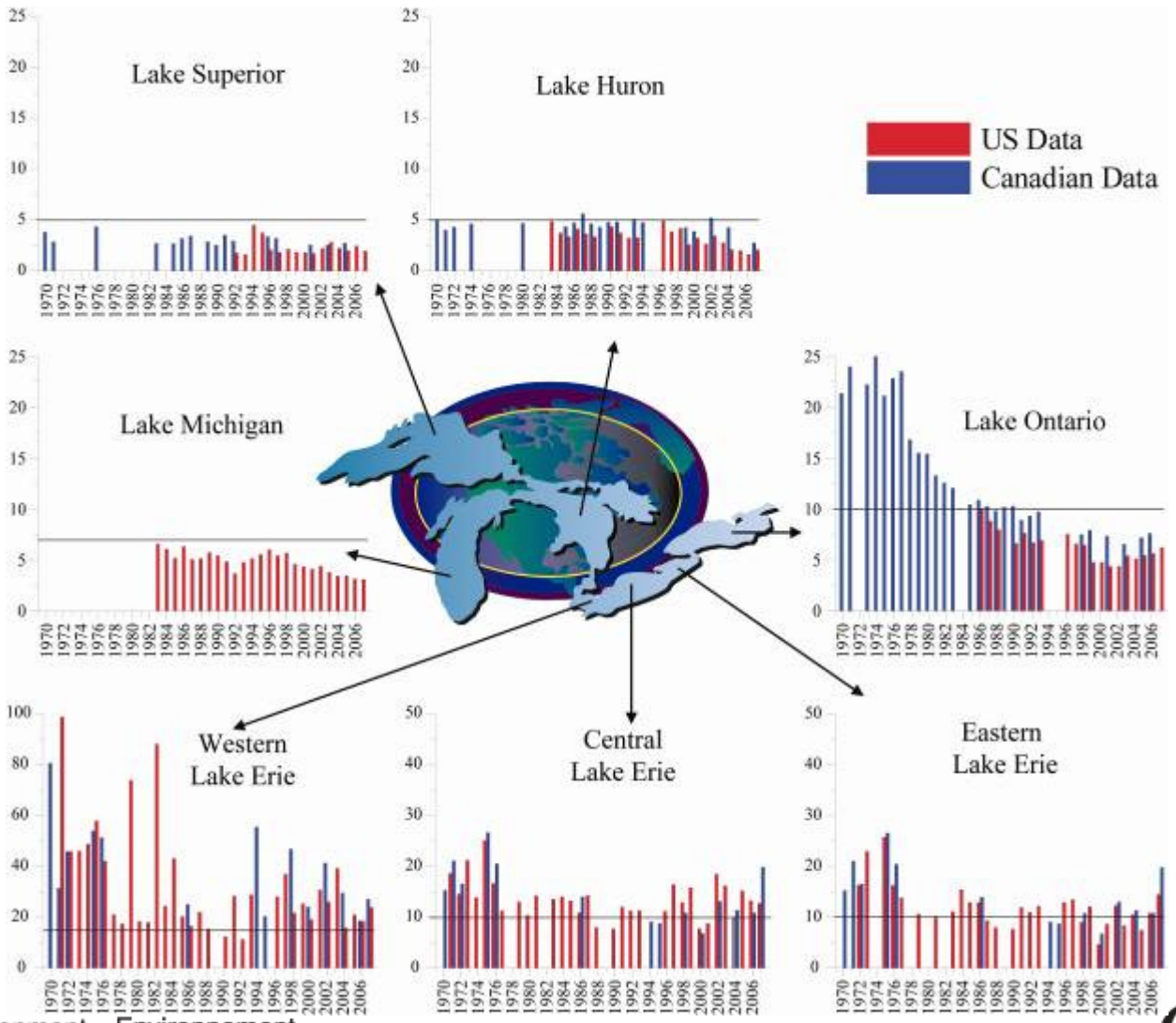
- Beaches open 95% of swimming season
- Beaches posted 5-9% of swimming season time
- Beaches posted > 10% of swimming season

Environment Canada Environnement Canada

Excessive Nutrients

- Efforts in the 1970s largely successful
- increasing proportion of the phosphorus is dissolved
- Re-emergence of *Cladophora* fouling of shoreline and cyanobacteria blooms reported for all Lakes except Superior
- Changes in algal species composition throughout the Great Lakes

Offshore Total Phosphorus Trends

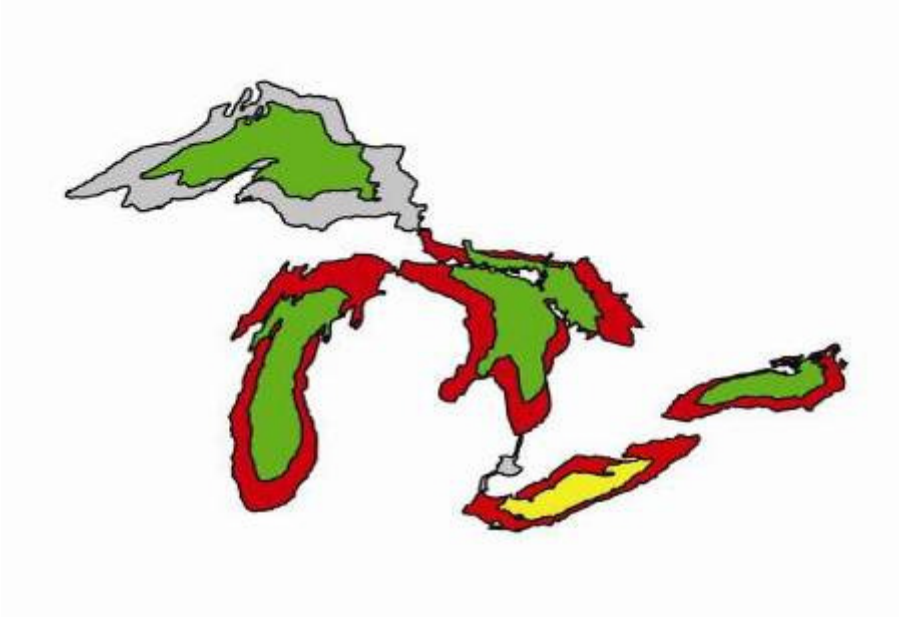


Excessive Phosphorus

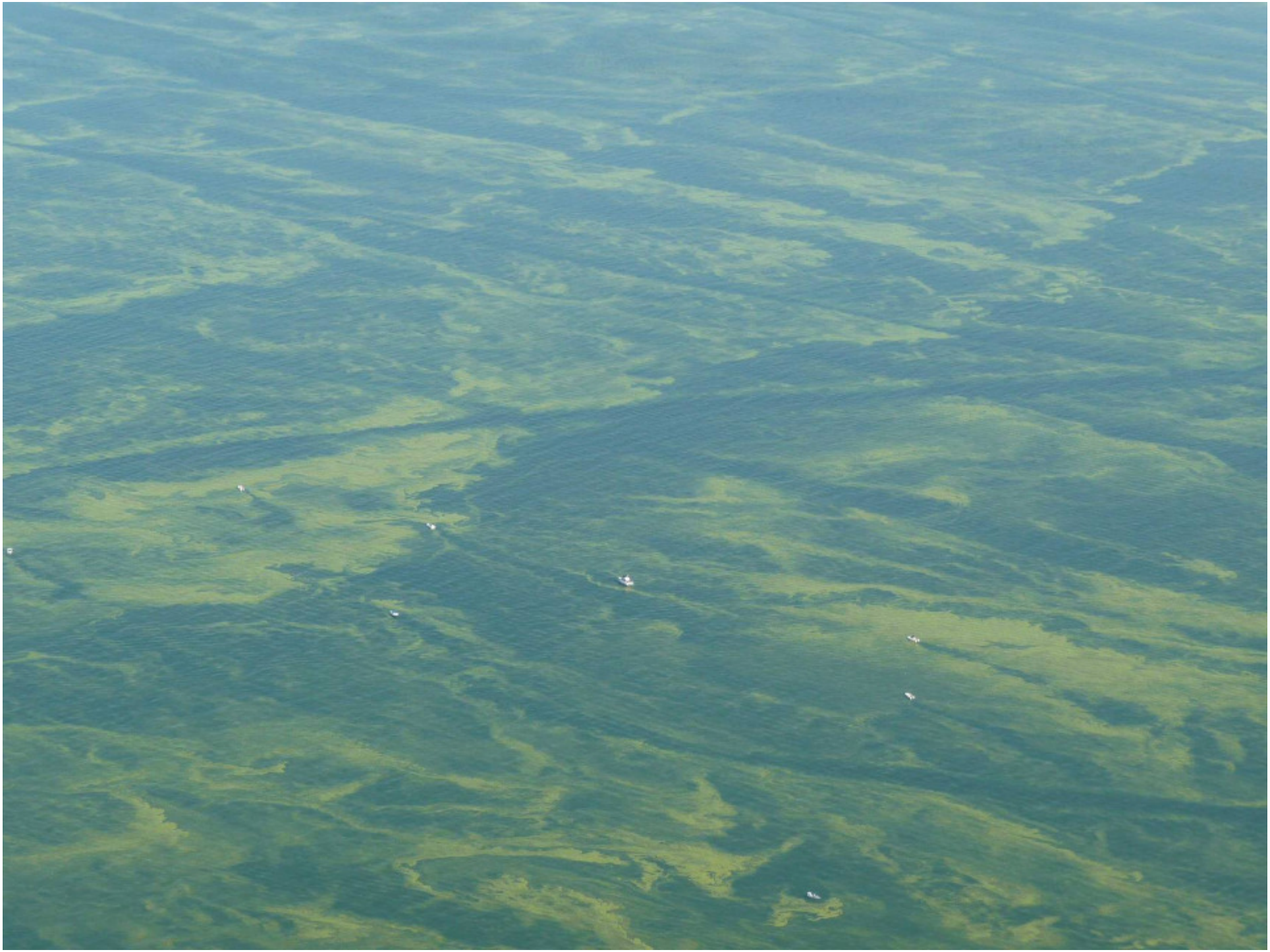
Total Phosphorus in the Nearshore

Lake Huron and Lake Ontario: some nearshore areas and embayments experiencing elevated levels

Lake Erie: extensive lawns of *Cladophora* are common place over the Eastern nearshore lakebed



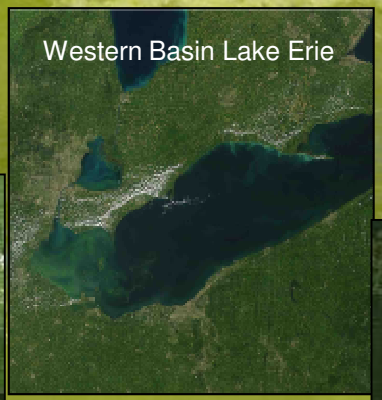
Status of phosphorus can be quite different between the nearshore and offshore waters of each lake



Cyanobacteria (bluegreen) Algal Blooms

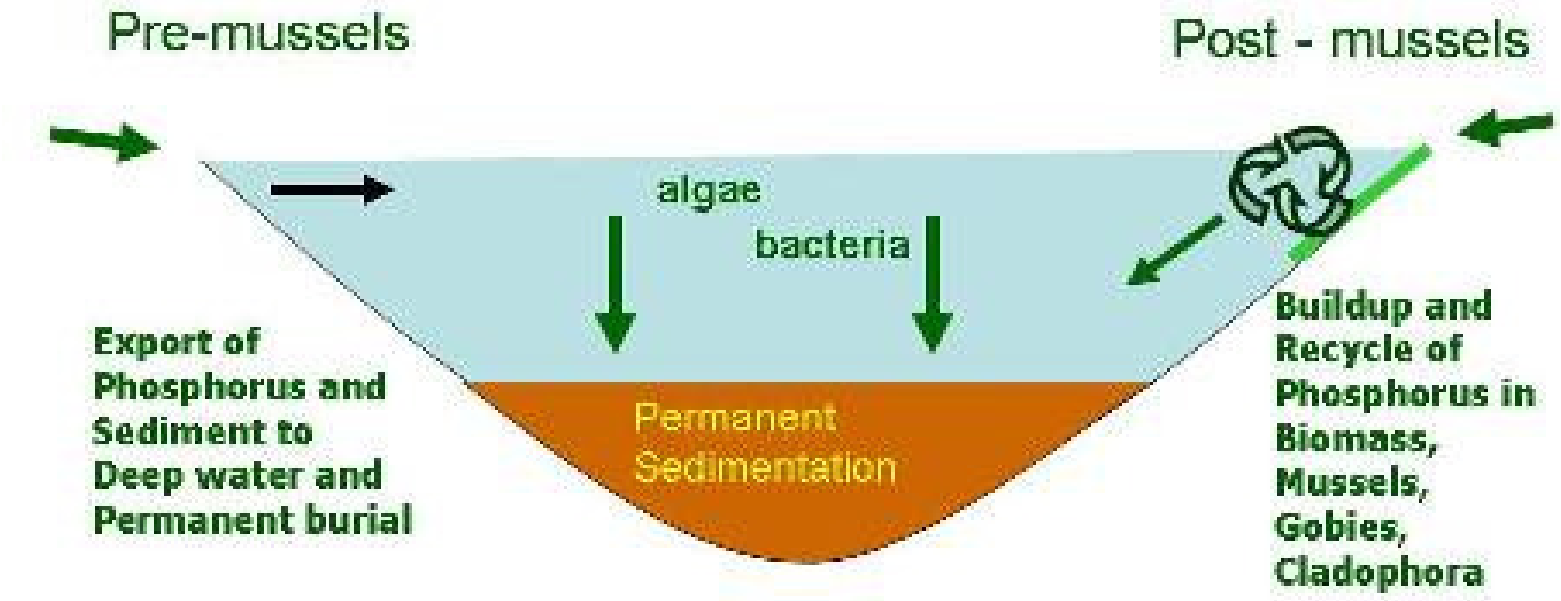
HABs have been responsible for the closure of beaches, death of wildlife and require additional treatment of drinking water.

HABs include cyanobacteria, especially *Microcystis*, which produce potent toxins that sometimes exceed safe drinking water guidelines for raw water (NOAA)



Benthic Shunts

Nearshore



Urban sources of phosphorus impacting Lake Erie nearshore zone

- Urban sources of phosphorus include wastewater treatment plant (WWTP) effluents, combined sewer overflows (CSOs), and stormwater
- Total phosphorus loading to Lake Erie about 10,000 metric tonnes per year, of which 1,900 are attributed to municipal point source discharges (directly into the lake, or indirectly via tributaries)
- estimated Canadian share is 150-290 MTA
- Additional phosphorus is discharged with combined sewer overflows (5 MTA) and stormwater discharges (40 MTA)

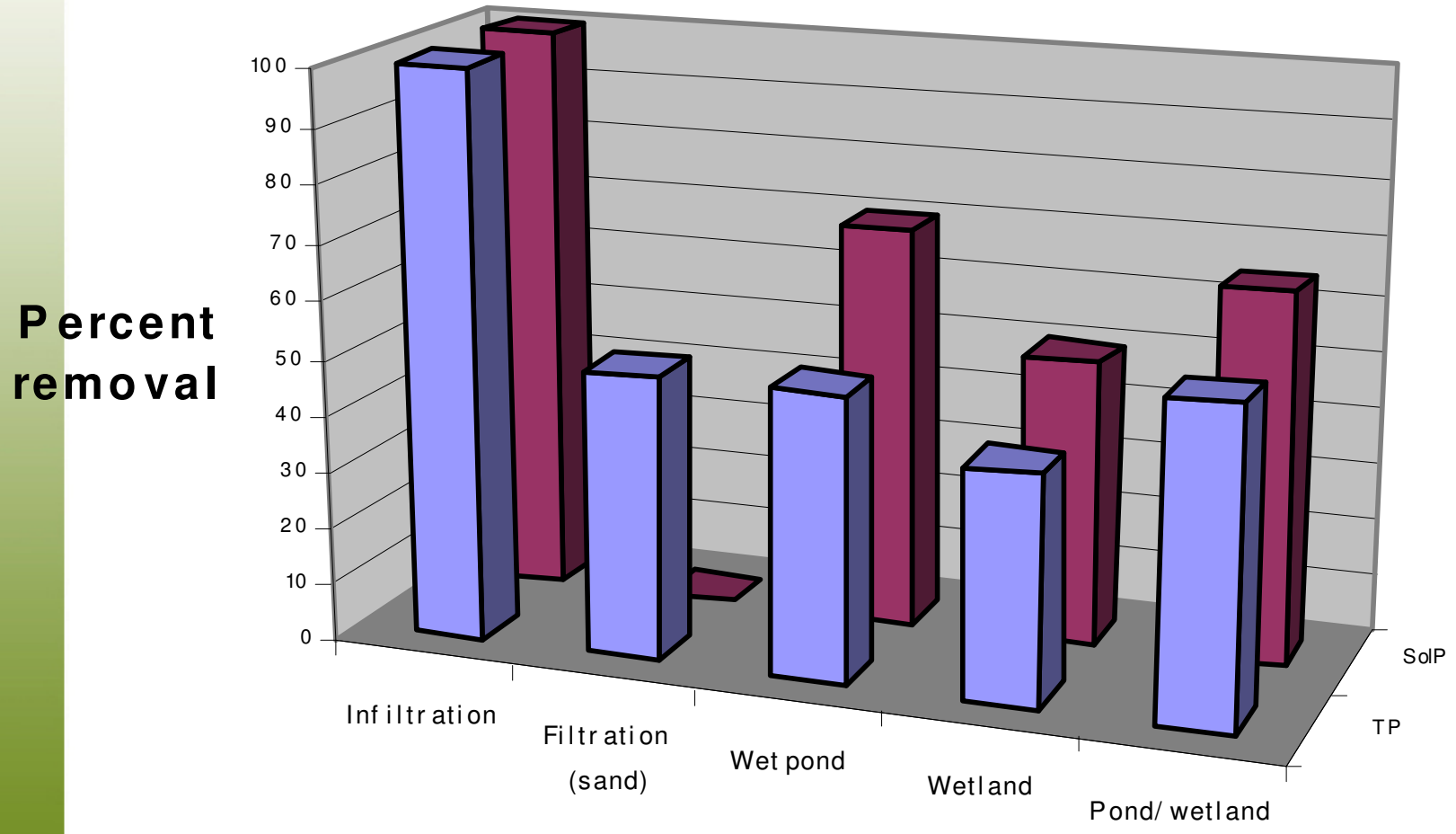
Characteristics of Urban Effluents

Constituent/ source	Raw dome-stic WW	2nd effl. + BNR	CSOs	SW
TSS	200	5-20	400	100
TN	40	2-12	8	3.5
Ammonia	25	< 1	4	0.5
TP	7	0.1-0.5	2	0.33

Management options for urban sources

- Wastewater treatment with phosphorus removal
- CSO treatment and control
- Stormwater loading can be reduced by BMPs
- Stormwater management

BMPs for Phosphorus removal



Why are urban sources important?

- Small but important contributions
  - transition from undeveloped to developed land found to increase nutrient concentrations in the nearshore zone
  - comprised primarily of dissolved reactive phosphorus (highly bioavailable)
  - Point sources can be controlled more readily than nonpoint sources
- nearshore nutrient management requires control of urban sources of nutrients

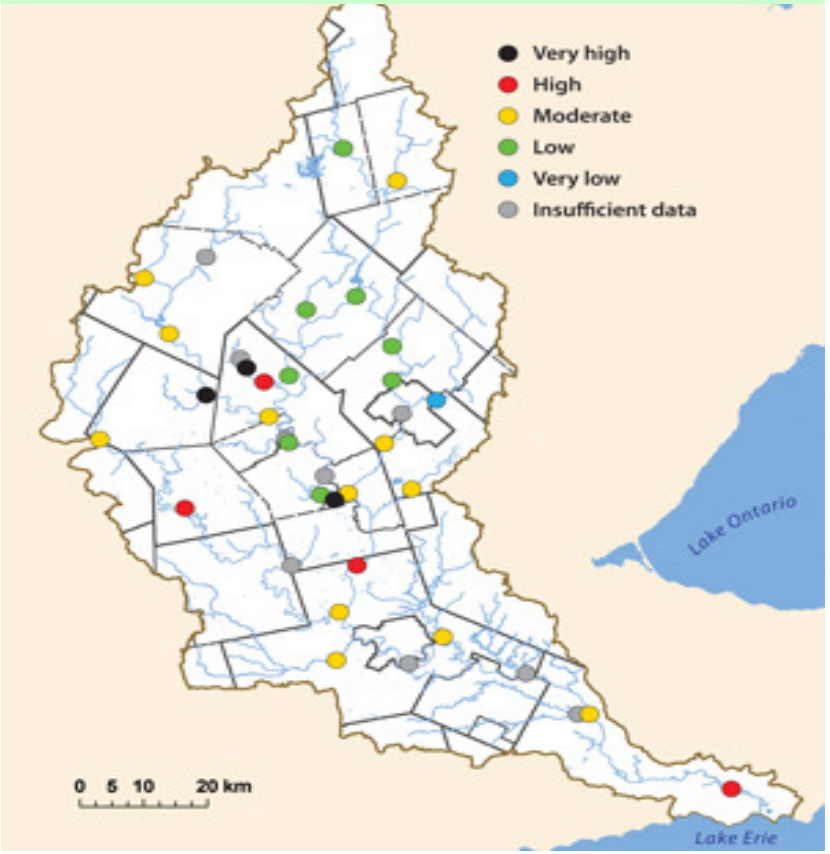
Watersheds: Effects on the Great Lakes

- **Excessive nutrients** – Causing Cladophora and plankton blooms and low oxygen levels
- **High levels of Suspended Solids**
  Episodic - lethal conditions for aquatic life, reduced habitat quality, prevents macrophyte growth
- Creates conditions suitable for **invasive species**
- **Temperature and Oxygen** levels occasionally lethal
- **Dams** preventing fish access, fragmenting river preventing movement of bedload
- **Wetland loss & degradation**
- Channel alterations **reduce habitat complexity.**
- Potential Sources of **Toxic Substances** and **Bacterial Contamination**

Watershed – Lake Connections

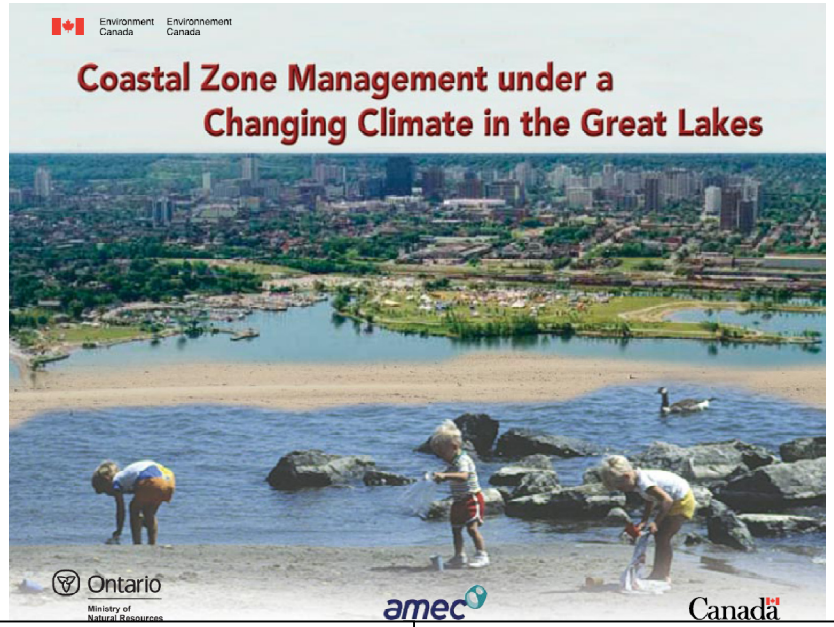
- Lake Huron Southeast Shores Steering Committee
- Grand River Water Management Plan Steering Committee

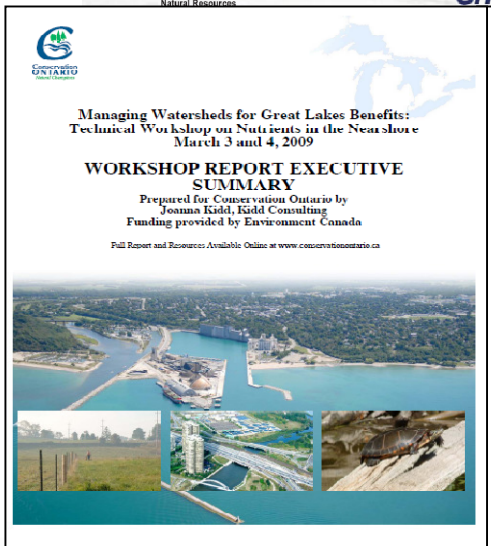
Nutrient levels
in the Grand River watershed



Recent Workshops and Reports

- Coastal Zone Management under a Changing Climate in the Great Lakes 2006
- Great Lakes Climate Change and Policy Workshop 2009
- Managing Watersheds for Great Lakes Benefits: Technical Workshop on Nutrients in the Nearshore 2009

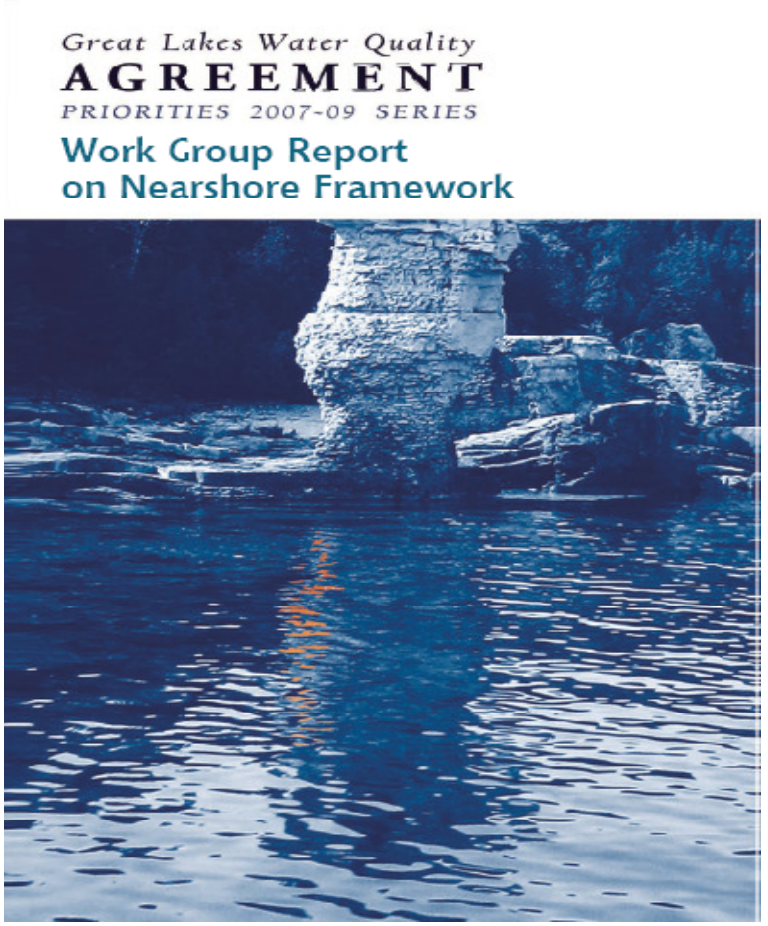




Environment Canada Environnement Canada

IJC 2009 Nearshore Report Recommendations

- Explicitly recognize the nearshore
- Specify adaptive management
- Specific goals and objectives
- Binational condition assessment as component of Lakewide Management Plans
- engage institutions and agencies at all orders of government, including facilitating the development of shared priorities and coordinating programs, research, monitoring and management initiatives.

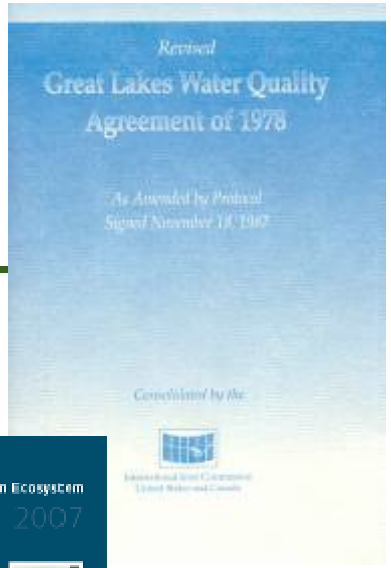


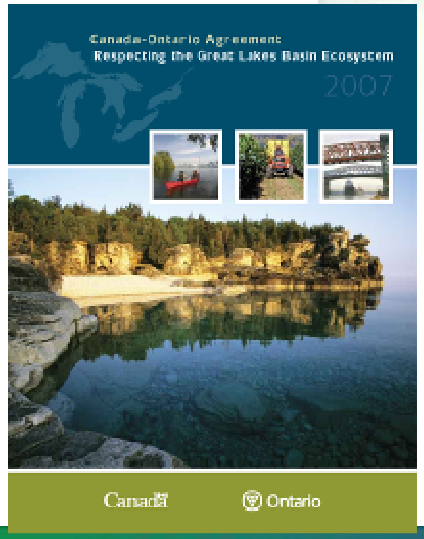
COA 2011-12

- *Canada and Ontario will develop options and engage stakeholders and Aboriginal communities on a Canadian framework to assess and protect the aquatic ecosystem health of Great Lakes' nearshore.*

Coastal Opportunities

- GLWQA Negotiation
- Coastal collaborations
- Federal Budget 2011
- COA 2011-12
  - Nearshore
  - New Agreement negotiation
- SOLEC Oct 26-27/11





Environment Canada Environnement Canada

Concluding Remarks

- One of the most important freshwater resources in the World
- The lake ecosystems are constantly changing
- The Coastal Zone is under stress and in need of restoration and protection
- Nearshore nutrient management requires control of urban sources
- Ecosystem recovery is a long term process
- Partnerships are required
- We must all do more and there is a role for everyone, including stormwater managers!

For more Information

John Marsden
Manager
Great Lakes Management and Reporting Section
Great Lakes Division
Environment Canada
4905 Dufferin Street
Toronto ON M3H 5T4
john.marsden@ec.gc.ca
Telephone 416-739-4759
Facsimile 416-739-4804
Cell 416-320-7574
Government of Canada Website www.ec.gc.ca/greatlakes

Celebrating 40 years of environmental leadership!