

**UNIVERSITÉ
LAVAL**

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CANADA-USA AGREEMENT ON EUTROPHICATION CONTROL AND PROTECTION OF LAKE CHAMPLAIN

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The University of Vermont

Lake Champlain watershed characteristics



Physical parameter	Value
Average Depth (m)	2,8
Max Depth (m)	4
Surface Area (km ²)	77,5
Water Volume (x10 ⁶ m ³)	131,6
Watershed Surf. Area CP (km ²)	1 200
Input water	gw + trib.+ ro.
Quality parameter	Value
TP (µg/l)	43-86 (w c)
QC w = 20 µg/L	1500 ppm (s)
Chl a Biomass (µg/l)	7-70
QC w = 8	
Transparency (m)	0,8-1,0
QC w = 1.5m	
pH	7,0-9,5
Dissolved Oxygen (%)	85
HM (Pb, Zn, Cd)	> M EL (+ Hg)

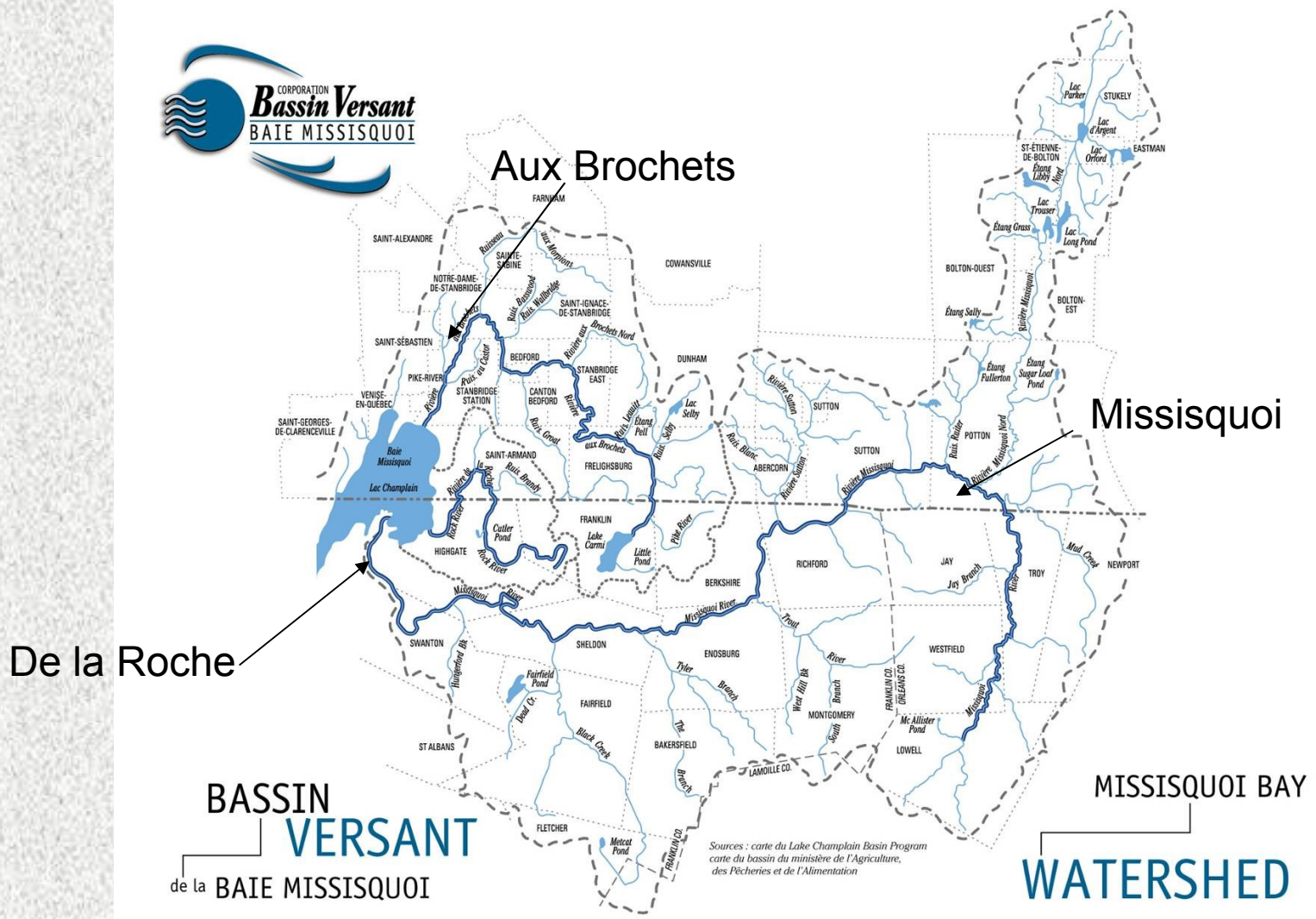
TP = Total Phosphorous;
 HM = heavy metals;
 M EL = M inimal effect level;
 QC = Quality Criteria;
 gw = groundwater; ro = runoff; w c = water column;
 s = sediments;
 CP= Canadian portion.



The facts

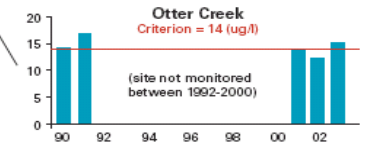
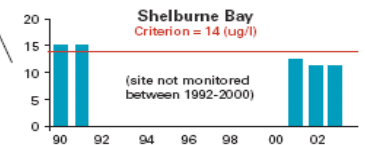
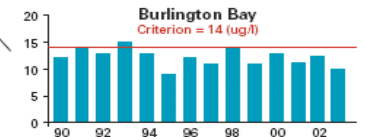
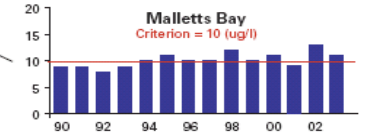
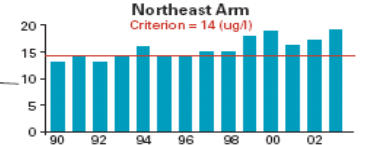
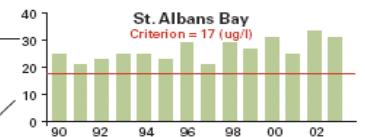
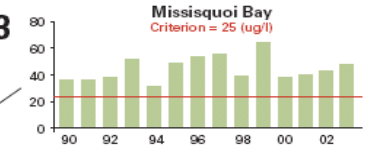
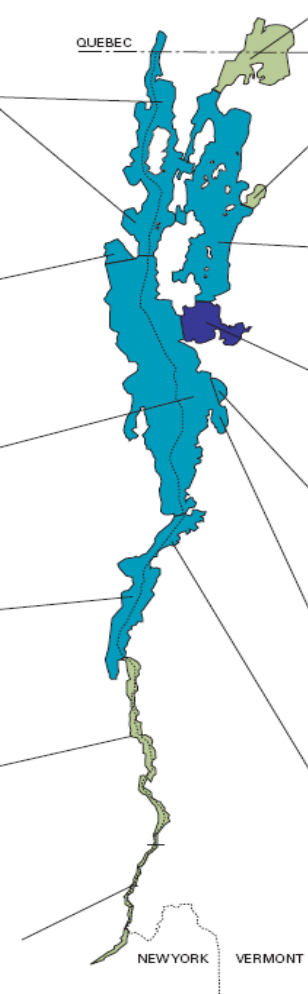
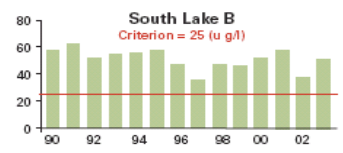
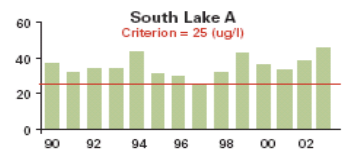
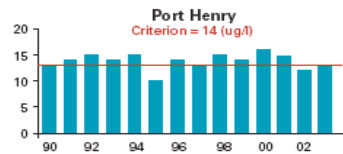
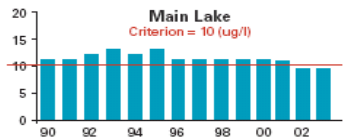
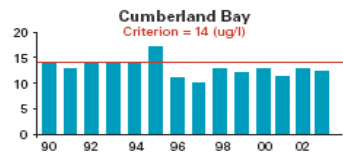
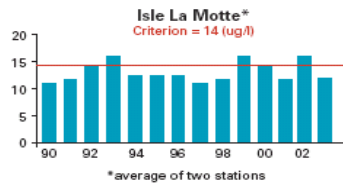
- Land use for the overall watershed is 62% forested, 25% agricultural, and 5% urban
- Missisquoi Bay is an important vacation area for the region. Fishing is popular year around, and resorts with boating and swimming operate in summer.
- Water quality is important for recreation and tourism.
- Water is used to irrigate crops.
- Drinking water sources for the municipalities of Bedford and St Armand in Philipsburgh sector. Quebec's southern Estrie region, have drinking water intakes in Missisquoi Bay.
- Lake Champlain is very important to CANADA and USA history. It has been the site of battles in the French-British-Indian War, U.S. Revolutionary War, and War of 1812.

Lake Champlain Watershed: Rivers @ both sides of the Canada-USA border, P- loads



Phosphorus Levels in Lake Champlain 1990-2003 Compared with Water Quality Criteria (red lines)

Note: ug/l = micrograms/liter

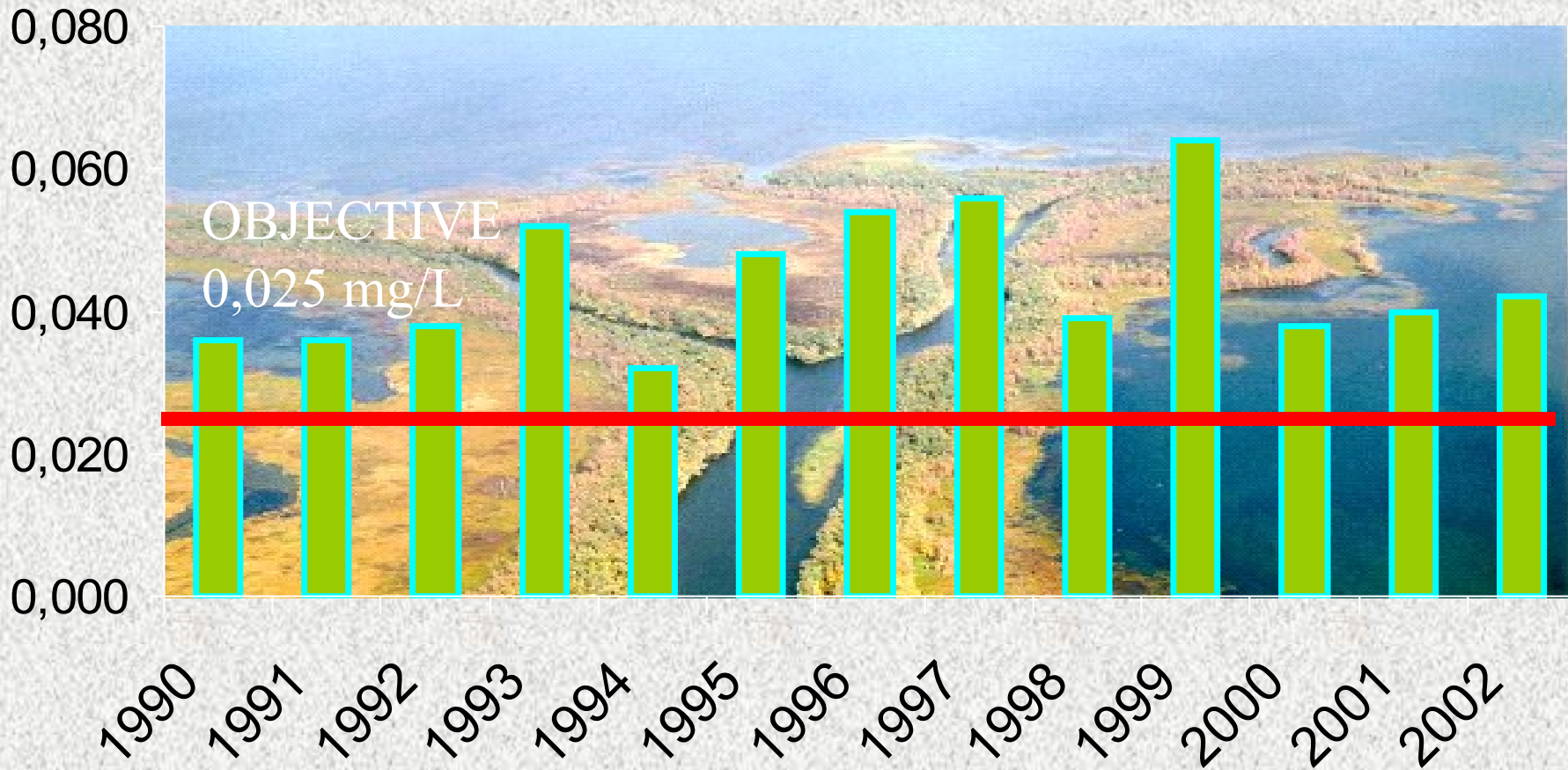


Eutrophic State (mg/l)	
0-10	Oligotrophic low algae growth & high water clarity
11-20	Mesotrophic moderate algae growth & water clarity
21 +	Eutrophic excessive algae growth & low water clarity

Map by LCBP

DATA SOURCE: VERMONT DEC

Quebec side: P @ Missisquoi Bay



Quebec side: Cyanobacteria @ Missisquoi Bay

2001

Aphanizomenon flos-aquae

Microcystis flos-aquae

Anabaena flos-aquae

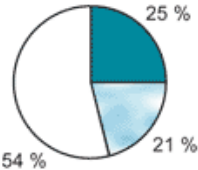
Croococcus dispersus

Merismopedia punctata

Aphanotece clathrata

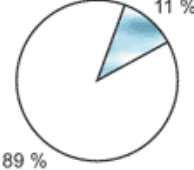
Aphanocapsa elachita

21 juin



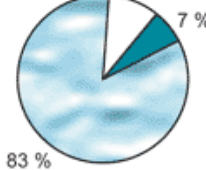
Merismopedia glauca 21 %
Aphanizomenon gracile 17 %

12 juillet



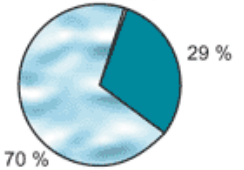
Aphanotece clathrata 6 %
Merismopedia punctata 5 %

31 juillet



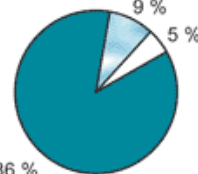
Chroococcus dispersus 57 %
Aphanocapsa elachista 24 %
Microcystis flos-aquae 69 %

29 août



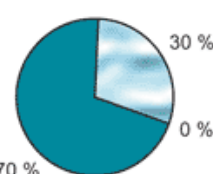
Aphanotece clathrata 69 %
Anabaena flos-aquae 11 %
Microcystis flos-aquae 9 %
Aphanizomenon flos-aquae 9 %

5 septembre



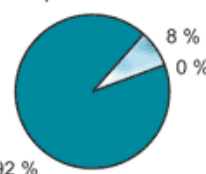
Microcystis flos-aquae 46 %
Aphanizomenon flos-aquae 35 %

11 septembre



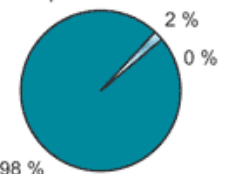
Aphanizomenon flos-aquae 61 %
Aphanocapsa elachista 19 %

19 septembre



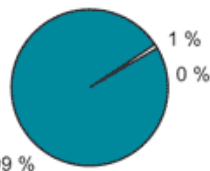
Aphanizomenon flos-aquae 79 %
Microcystis flos-aquae 13 %

26 septembre



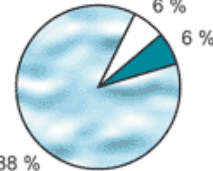
Microcystis flos-aquae 58 %
Aphanizomenon flos-aquae 40 %

2 octobre

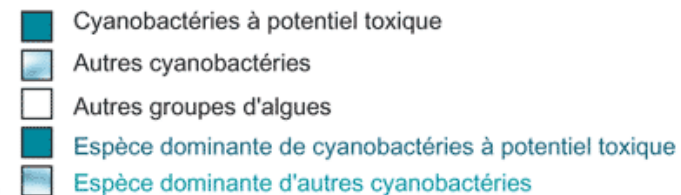


Aphanizomenon flos-aquae 70 %
Microcystis flos-aquae 28 %

15 octobre



Chroococcus dispersus 82 %
Aphanizomenon flos-aquae 6 %





The agreement

- On August, 2002 in Quebec City, an agreement was signed between Vermont (USA) and Québec (Canada) regarding phosphorus reduction in the Missisquoi Bay (Lake Champlain) watershed.
- Sustainable development principles: Phosphorous control by source reduction, Protection of Aquatic ecosystems and human health by protecting drinking water sources.
- Encourage and exploit the Touristical-Recreational-Educational potential in relation to water usages and various aquatic ecosystems within watershed.
- The agreement states that Vermont will have 60% of the responsibility for reducing phosphorus loads to the Bay, and Quebec will assume 40% of the responsibility.
- Accordingly, the target phosphorus load for Vermont will be 58.3 metric tons per year (m^3/yr), and the target load for Quebec will be 38.9 m^3/yr .



The Plan to reduce P loads

- Wastewater treatment plant upgrades
- Best management practices on farms to reduce nutrient runoff
- Stabilization of stream banks and stream channels
- Better storm-water management and erosion control on developed land and roadways.

*Quebec was able to proceed more quickly with **mandatory regulations** and **outright no contact/closed beaches policies** while in Vermont all actions are strictly voluntary and consequently slow.



The Actions

- CBVBM - ONG (1999) – community group
- MDDEP – Ecosystem Quality monitoring
- Wastewater treatment plants (90% service attained)
- Remediation projects at Venise Bay
- Laval, UQAM – Research Studies
- Lake Champlain Research Consortium
- ECHO – Lake Aquarium and Science center
- Lake Champlain Research Institute

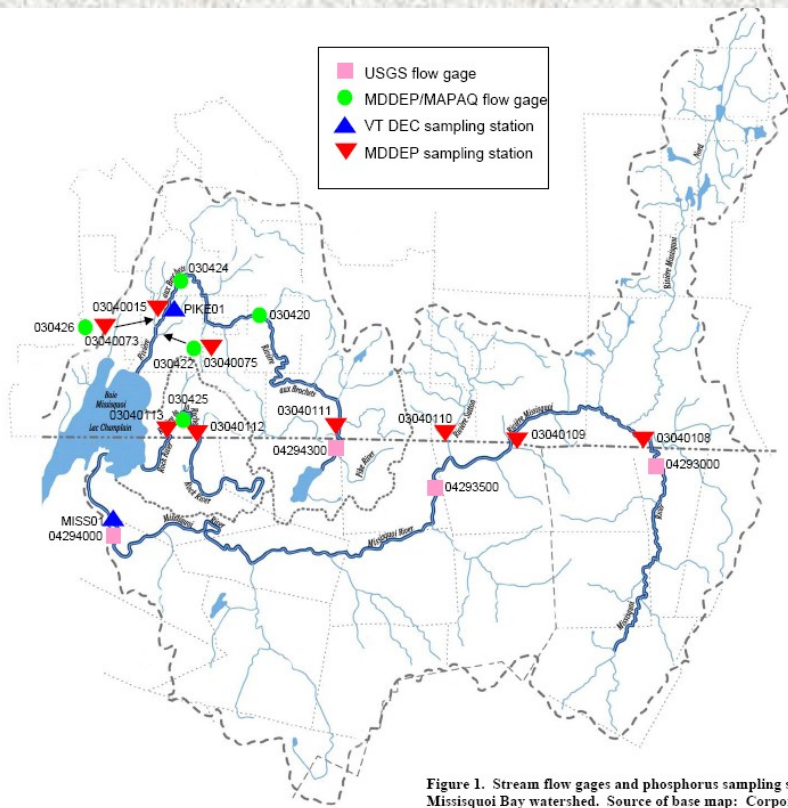
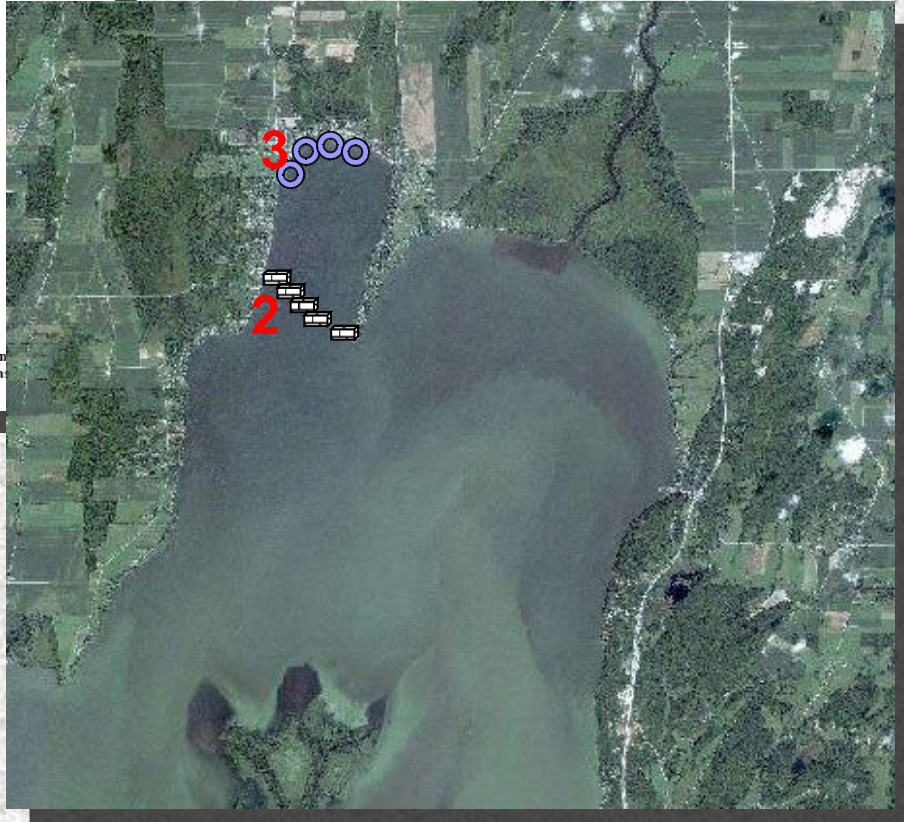


Figure 1. Stream flow gages and phosphorus sampling stations in Missisquoi Bay watershed. Source of base map: Corporation Ba Baie Missisquoi.



P-Monitoring planning
 Tests of Oxygenation/coagulation

Merci!



