The Missisquoi Bay Watershed Action Plan

Efforts must be stepped up to enhance phosphorus reduction. The joint action plan for the Missisquoi Bay Watershed aims to implement such actions in partnership with area organizations and municipalities, and the Québec government. Following are some examples of planned actions.

- ✔ Municipal representatives will take steps to ensure work is completed on wastewater treatment infrastructures, and emphasize the important role homeowners must play in reducing phosphorus (septic systems, fertilizer use, shoreline erosion).
- ✔ Farm organizations will carry out work to restore and protect riparian buffer strips along the farmland watercourses identified as high-priority (the Ewing, Au Castor, Aux Morpions and Wallbridge streams). The work will emphasize the adoption of soil and water conservation methods with a view to reducing phosphorus losses.
- ✔ The Québec Ministry of the Environment will step up water quality sampling and flow rate measurements to have a better idea of phosphorus concentrations and loading. Environmental groups will work to raise awareness among elected officials and citizens in order to achieve the reduction goal of 27.3 tons/year by 2016.
- ✔ Tourism and economic sector representatives will be contacting companies affected by phosphorus reduction and raising making citizens aware of how important improved water quality is to recreational activities.

The mission of the Corporation Bassin Versant Baie Missisquoi

The Corporation's mission is to "PROMOTE THE ENHANCEMENT OF WATER QUALITY in Missisquoi Bay, Lake Champlain, so as to render it usable again and harness its resources from a sustainable-development perspective."

Its main objectives are as follows:

- ➤ Develop, implement and ensure monitoring of an ACTION PLAN.
- ➤ Rally, mobilize and ensure JOINT ACTION by local stakeholders.
- ➤ RAISE AWARENESS among municipal authorities, farm producers and other stakeholders.
- ➤ Inform, raise awareness among, and CONSULT THE POPULATION.
- ➤ REPRESENT the citizens of Québec before the Lake Champlain Basin Program Steering Committee.

Corporation members with voting rights include representatives of municipal, agricultural, environmental and tourism/economic groups. Citizens can become members in the capacity of "Friends of the Corporation."

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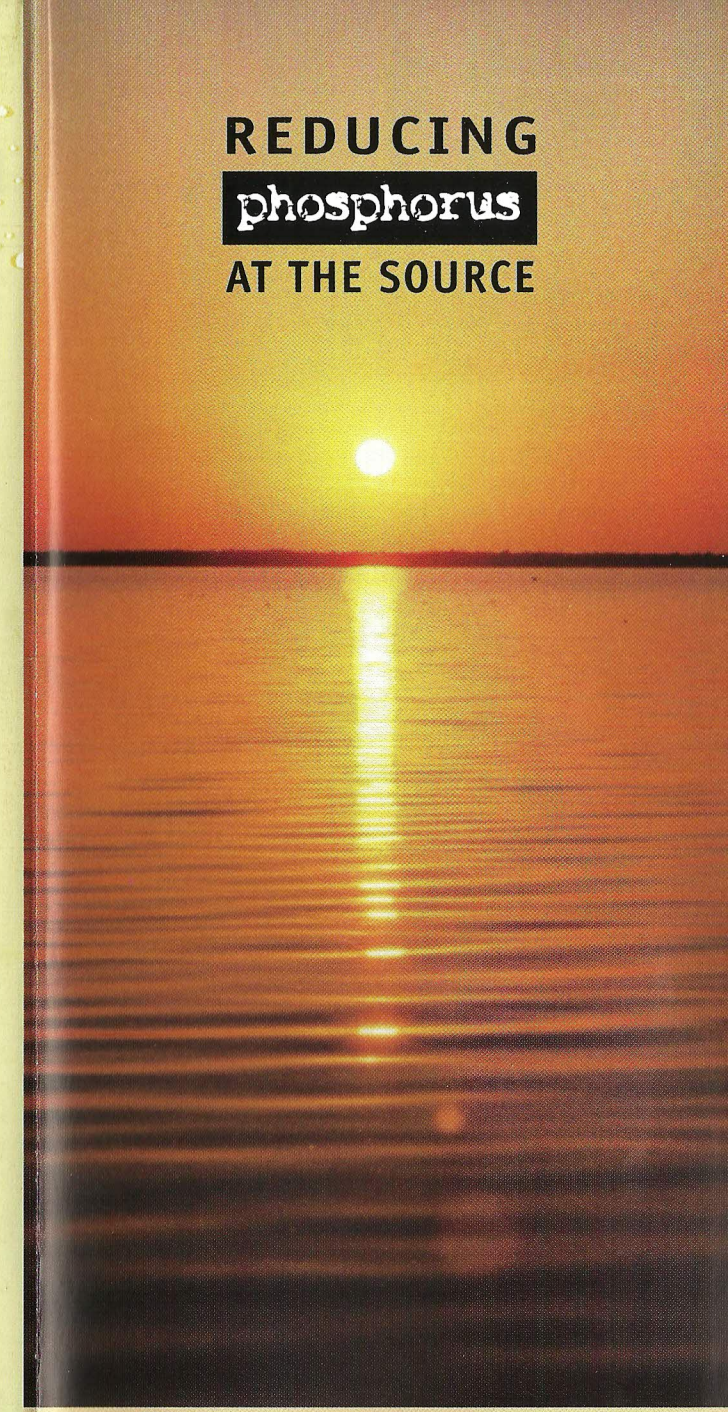
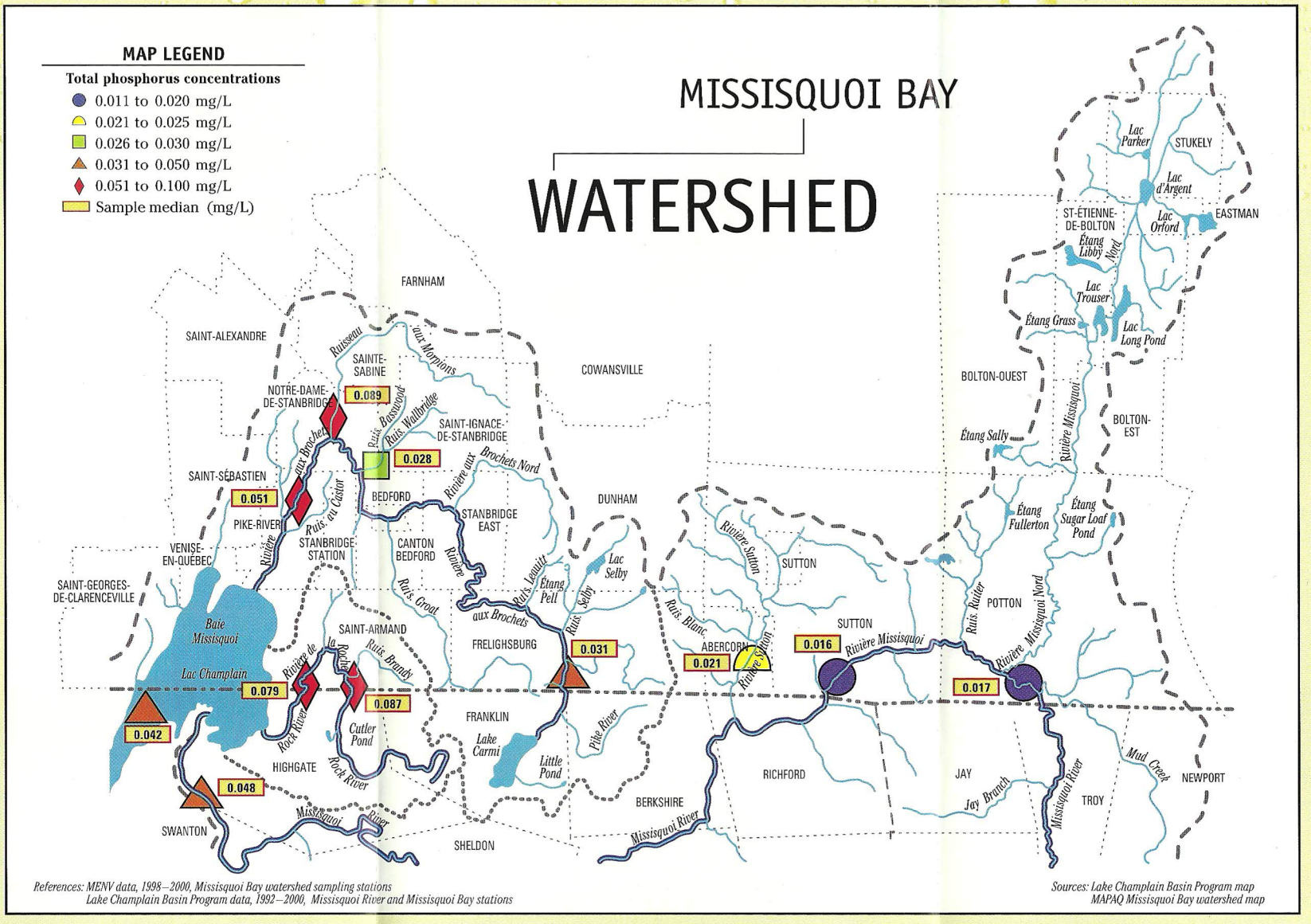
REDUCING phosphorus AT THE SOURCE



Corporation Bassin Versant Baie Missisquoi

A source of solutions
A network for action

PHOSPHORUS CONCENTRATIONS



References: MENV data, 1998–2000, Missisquoi Bay watershed sampling stations
Lake Champlain Basin Program data, 1992–2000, Missisquoi River and Missisquoi Bay stations

Sources: Lake Champlain Basin Program map
MAPAQ Missisquoi Bay watershed map

CRITERIA FOR TOTAL PHOSPHORUS

Trophic states selected by Lake Champlain Basin Program

Oligotrophic: (young lake; clear, clean water; few aquatic plants)
Concentration **less than 0.010 mg/L**

Mesotrophic: (mature lake; cloudy water; fair number of aquatic plants)
Concentration **between 0.011 mg/L and 0.020 mg/L**

Eutrophic: (old lake; turbid water; many plants)
Concentration **greater than 0.021 mg/L**

LCBP target for Missisquoi Bay

· Concentration of **0.025 mg/L**

Québec Ministry of the Environment criteria

· To restrict excessive growth of algae and aquatic plants (rivers):
Concentration less than **0.030 mg/L**

· Indicative of significant phosphorus entry:
Concentration greater than **0.050 mg/L**

THE IMPACTS OF phosphorus

Analysts who study aquatic habitats consider phosphorus to be the number one threat to ecosystem balance. Paradoxically, phosphorus is essential to all living things. When too much of it gets into the water, though, this leads to an imbalance that has a strong adverse effect on the health of ecosystems and, potentially, an impact on our drinking water and on recreational and tourism activities.

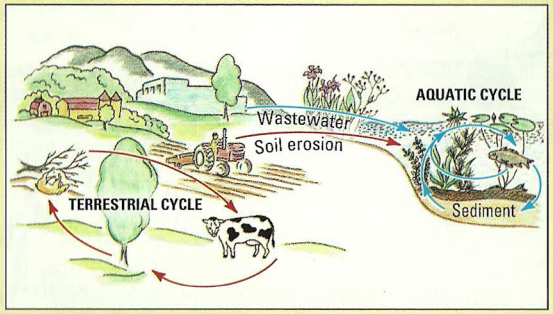
Phosphorus, FOR LIFE!

Phosphorus is a naturally occurring element that is vital to both the vegetable and animal worlds. In the case of plants, phosphorus is an essential nutrient—that's why it's a common ingredient in fertilizer, usually in the form of *phosphorus pentoxide* (P_2O_5).

Fertilizers are always identified according to their percent concentrations of nitrogen, phosphorus and potassium. Nitrogen encourages foliage, phosphorus promotes flowering, and potassium is good for the roots of plants.

Phosphorus is mainly used as fertilizer, in combination with nitrogen and potassium.

In animals, phosphorus is essential for strong bones and teeth, neuron growth, and storage and transportation of energy inside the body. An adult human consumes between 1 and 2 grams of phosphorus per day, and the body rejects 50% of it. Contrary to popular belief, the flesh of fish is no richer in phosphorus than other meats.

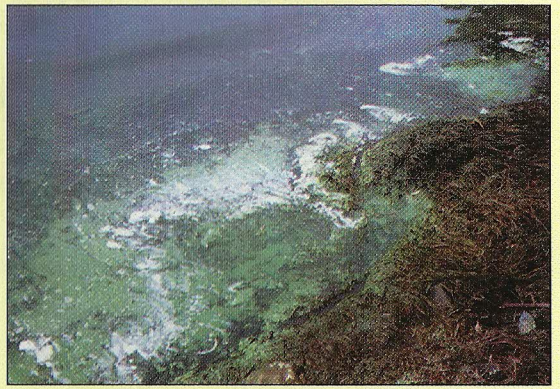


The natural phosphorus cycle is fairly simple, but becomes complex with the release of phosphorus contained in sediment.

Phosphorus generates STRONG REACTIONS!

Increased application of various types of fertilizer, as well as use of detergents containing phosphates, have led to high concentrations of phosphorus in our lakes, rivers and streams. The unexpected influx of phosphorus quickly leads to disproportionate growth, because this nutrient is so beneficial to aquatic plants, algae and microorganisms.

Under these conditions, the natural phosphorus cycle is severely perturbed. Microscopic algae, which thrive on dissolved phosphorus, proliferate until the water starts to look like green soup—a phenomenon known as an *algal bloom* or, more colloquially, "pond scum." Filamentous algae attach themselves to any available surface, while aquatic plants form dense, impenetrable canopies as they absorb phosphorus stored in the sediments of water bodies.



Algal blooms contain *cyanobacteria* (sometimes called "blue-green algae"), which can release toxins into the water.

The natural aging of waterbodies due to enriched nutrient material is called *eutrophication*. Excess phosphorus causes accelerated eutrophication.

When algae and plants die, microorganisms decompose this organic matter, releasing even more phosphorus into the water. Breaking down the organic material uses up oxygen, and the less dissolved oxygen there is in the water, the more difficult it is for life to exist there!

As organic matter decays, particles build up on the bottoms of lakes and streams. This interferes with fish spawning grounds, and heats up the water. When the oxygen is depleted, the water becomes putrid, giving off foul odours. Phosphorus accumulates in sediment, where it can continue to dissolve into the water for years.

REDUCING phosphorus

TRACKING phosphorus

Phosphorus comes from the Greek word *phosphoros,* which means "bringer of light." Under humid conditions, the element burns slowly, giving off a greenish-white light—hence the term *phosphorescence.* In spite of this property, it is difficult to detect excess phosphorus in ecosystems because sources of phosphorus pollution are usually nonpoint (i.e. diffuse) and go unnoticed.

The quality criterion selected as part of efforts to protect Missisquoi Bay is 0.025 milligrams of phosphorus per litre of water. The map of the Missisquoi Bay watershed (see reverse) shows the total concentrations of phosphorus in the Bay and surrounding watercourses. Sampling in the De la Roche River, the Aux Brochets River, and Missisquoi Bay, however, reveals concentrations that exceed this threshold.

The Government of Québec and the State of Vermont recently reached an agreement on phosphorus reduction as part of the Lake Champlain Basin Program (LCBP).

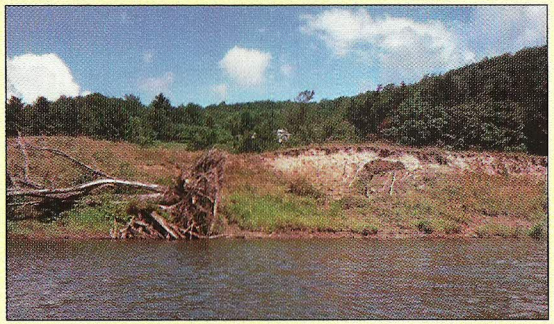
Water sampled from the Bay on August 13, 2001 has a greenish cast; compare with clear water sampled on July 18.

In 1991, phosphorus loading in Missisquoi Bay attributable to Québec sources was evaluated at 66.2 metric tons per year, of which 57.7 tons/year come from nonpoint sources. The agreement calls for phosphorus loading to be lowered to 38.9 tons/year by 2016, a reduction of 27.3 tons/year.

Fertilizers and SOIL CONSERVATION

Phosphorus is usually found in *particulate form*; that is, it has been adsorbed onto soil particles. These particles find their way into watercourses as the result of water erosion of soil as well as shoreline erosion. To limit inflows of particulate phosphorus, these soil losses must be reduced at the source. Better management of phosphorus levels in soil can also be achieved by reviewing application methods and rates for mineral fertilizer as well as solid and liquid manure.

Fertilizer should not be used on shoreline plots because it promotes increased growth of algae and aquatic plants near the water's edge. Plants that grow naturally on river and stream banks can control erosion and trap phosphorus in runoff water.



Shoreline erosion and agricultural soil loss causes phosphorus entry to watercourses.

Marshes and other wetlands play a very important role in the natural processing of surface water by consuming phosphorus and nitrogen as well as by retaining various water contaminants.

WASTEWATER treatment

Another major source of phosphorus is household wastewater. Municipal water treatment facilities, such as aerated ponds, must respect a rejection criterion of 1.0 mg/L or 0.8 mg/L—not quite zero!

Aerated ponds in Venise-en-Québec are subjected to a phosphorus reduction process known as *dephosphatation.*

Defective septic systems (poorly designed septic tanks or disposal fields) are another source of phosphorus contamination in surface water—and they also release significant amounts of bacteria.

Although a large-scale wastewater purification program has been implemented in Québec, phosphorus reduction in the home remains a significant challenge. Using phosphate-free detergents is one way we can considerably reduce phosphorus in household wastewater at the source.