

**REPORT OF THE LAKE CHAMPLAIN  
PHOSPHORUS MANAGEMENT TASK FORCE**

**May 14, 1993**

**Prepared for the  
Lake Champlain Steering Committee**

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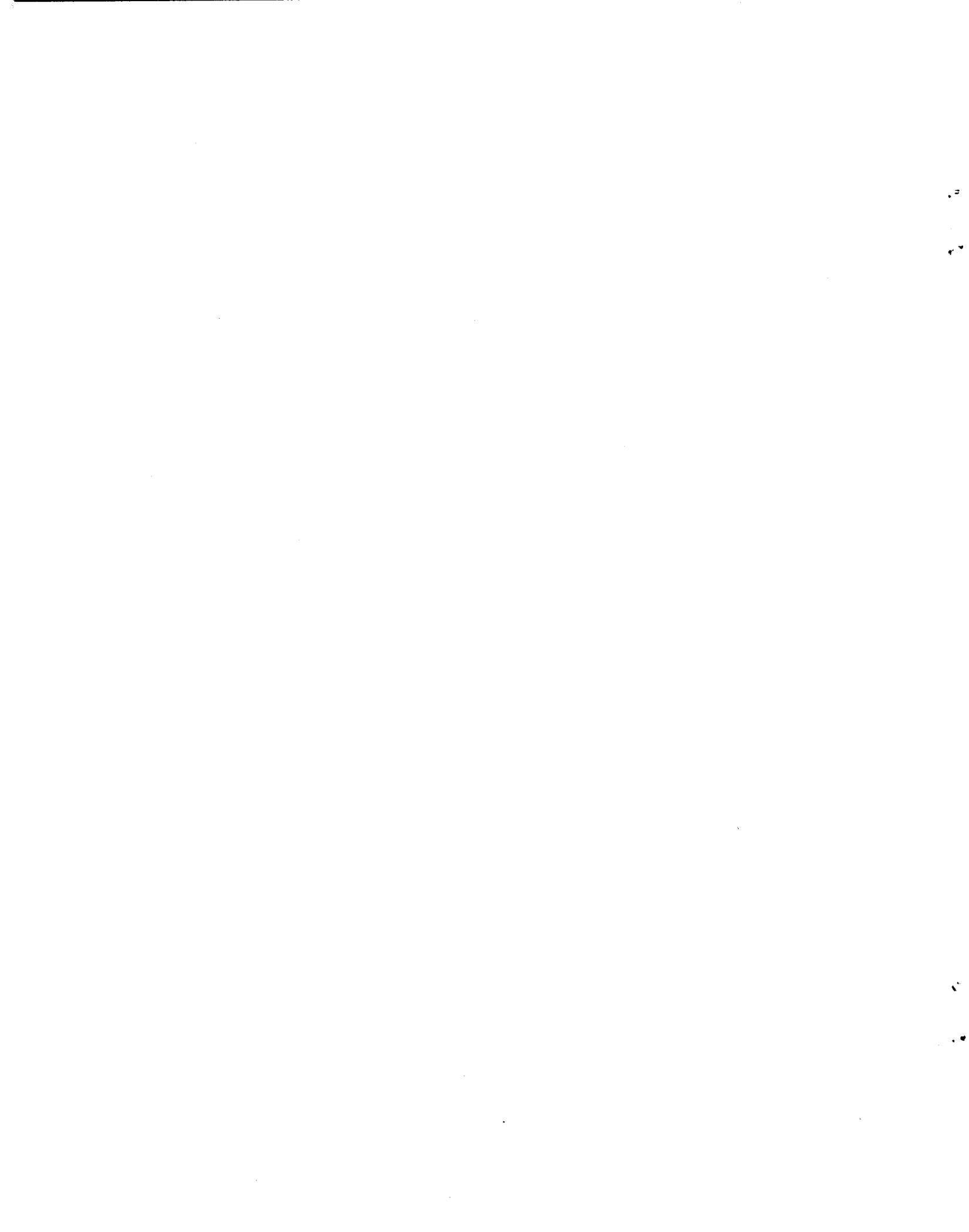
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## **BACKGROUND**

### **Lake Champlain Management Conference Goals and Objectives**

Eutrophication studies on Lake Champlain since 1979 have led to the conclusion that phosphorus levels in the lake are currently too high and should be reduced. Phosphorus levels in portions of the lake are as high as the most eutrophic parts of the Great Lakes during the 1970's. Eutrophication of the open water areas of the lake is the result of the cumulative impact of many point and nonpoint sources of phosphorus.

The Lake Champlain Management Conference, created by the Lake Champlain Special Designation Act of 1990, is developing a pollution prevention, control and restoration plan for Lake Champlain. In a March 1992 draft of the plan, the Management Conference identified the following goal for nutrient management:

**Nutrient Management Goal--Reduce phosphorus and other nutrient inputs to Lake Champlain so as to promote a healthy and diverse ecosystem and provide for sustainable human use and enjoyment of the Lake.**

The objectives of the draft plan map out a strategy for achieving this nutrient reduction goal. The strategy includes four main components:

1. Establish consistent standards.
2. Measure and model phosphorus.
3. Conduct load allocations.
4. Implement point and nonpoint source reductions.

### **Consistent Standards**

Objective 1 in the draft plan calls for the establishment of uniform, inter-state and international, numeric water quality standards for eutrophication-related parameters in each segment of Lake Champlain. Numeric standards may be set for such parameters as phosphorus, chlorophyll-a, Secchi disk depth, bottom dissolved oxygen level and biological indicators. Since phosphorus is the limiting nutrient for plant growth in the lake, and the other parameters are related to phosphorus concentrations, the emphasis to date has been on establishing consistent phosphorus standards.

### **Measure and Model**

Objectives in the draft plan identify the following needs for studying and modeling phosphorus in Lake Champlain:

1. Measure and monitor water and nutrient inputs from point and nonpoint sources,
2. Identify the factors (e.g. land use, management practices) that determine the magnitude of nutrient loadings from the watershed,

3. Predict aquatic community response to nutrient loadings to the lake, and
4. Enhance the predictive value of modeling efforts through additional research on watershed nutrient transport and transformation processes, in-lake nutrient transport processes, sediment-water interactions and nutrient bio-availability.

### Load Allocation

Once phosphorus inputs to the lake are known and a modeling capability exists, the plan calls for allocating point and nonpoint source phosphorus loading reductions in order to attain in-lake water quality standards. The initial allocation procedure will establish target phosphorus loadings for point and nonpoint sources in New York, Québec, and Vermont at the mouth of each major river (shown in Figure 1), to guide basin-wide nutrient management policies and priorities.

### Point and Nonpoint Source Reductions

Point and nonpoint source reductions of phosphorus will be required to attain in-lake water quality standards. It is unlikely that point source phosphorus controls alone will provide sufficient pollutant reductions to attain in-lake goals. Major new efforts in research and development of nonpoint source controls will be required. More information is also needed on the effectiveness of nonpoint source control practices and technologies.

### **Definitions**

The U.S. Federal Clean Water Act defines "water quality standards" to incorporate a number of related elements. These elements include the designation of desired uses for a water body, the setting of "criteria" to protect those uses, and an anti-degradation policy. Criteria may be either numeric or narrative in form.

States have the primary role in adopting water quality standards. The standards provide a legal basis for implementing wastewater discharge permitting programs and for controlling nonpoint sources of pollution. In New York and Vermont, state water quality standards are adopted or modified through formal state rule-making procedures, and have direct regulatory effect.

In Canada, the provinces have the primary role in natural resource management, including the regulation of water quality. Québec has established a province-wide numeric phosphorus criterion for lakes. However, this criterion is used as a management guideline only and does not have the same regulatory force as a state water quality standard in the United States. Water quality criteria for phosphorus are not established through a formal rule-making process in Québec.

The term "criteria" will be used throughout the remainder of this document to refer to existing or proposed phosphorus concentration objectives for Lake Champlain. However, it should be recognized that such criteria have a different regulatory meaning in Québec than in the United States.

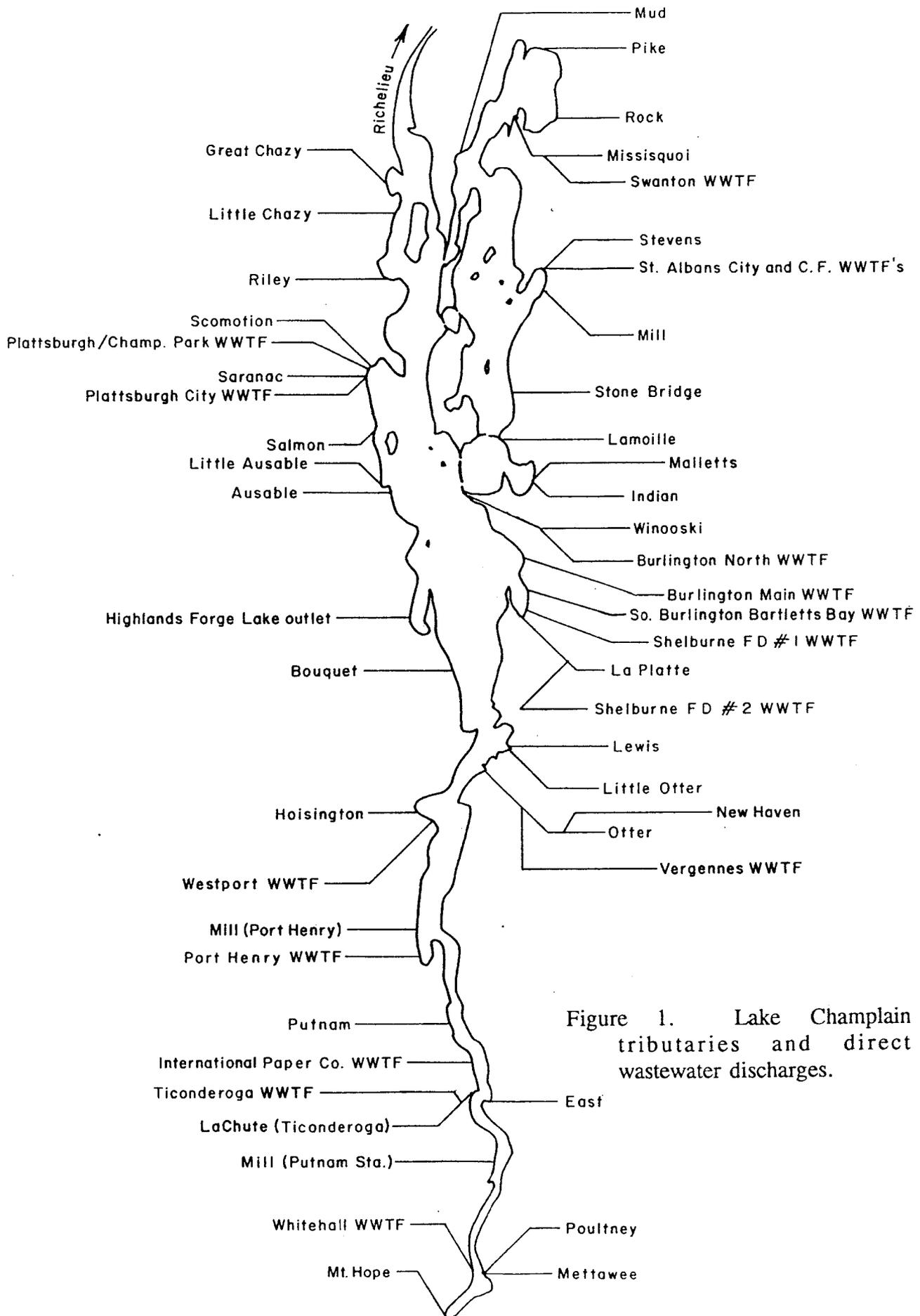


Figure 1. Lake Champlain tributaries and direct wastewater discharges.

## **Purpose of the Task Force**

In June 1992, the Lake Champlain Management Conference concluded that New York, Québec, and Vermont should consider establishing consistent phosphorus standards for Lake Champlain. They asked the Lake Champlain Steering Committee, created under a 1988 Memorandum of Understanding on Environmental Cooperation on the Management of Lake Champlain, to pursue the issue. In August 1992, the Steering Committee established a Phosphorus Management Task Force and charged them with the following:

1. Evaluate New York, Québec, and Vermont approaches to nutrient management, particularly phosphorus management,
2. Determine whether a consistent approach to phosphorus management is warranted or feasible, and
3. Report back to the Steering Committee with recommendations.

This report summarizes the Phosphorus Management Task Force findings and recommendations.

## **CURRENT EUTROPHICATION PROGRAMS AND POLICIES**

### **Water Quality Criteria**

#### Vermont

In 1991, the Vermont Water Resources Board established numeric, in-lake total phosphorus concentration criteria for 12 segments of Lake Champlain as part of the Vermont State Water Quality Standards. The criteria were derived from a quantitative analysis of Lake Champlain user survey data which related human use and aesthetic enjoyment of the lake to phosphorus and algae concentrations in the water. Criteria values were selected so as to prevent obvious algal nuisances and impairment of aesthetic enjoyment from occurring more frequently than about one day per summer. In some segments, the values were modified either upward or downward based on considerations of practical attainability or anti-degradation protection.

The Vermont phosphorus criteria are generally lower than the existing levels in the lake, and their attainment will therefore require substantial phosphorus reductions in the Vermont portions of Lake Champlain. The criteria are to be attained through policies and implementation measures adopted as part of a basin planning process applied to all phosphorus sources, both point and nonpoint. Individual discharges in compliance with the applicable implementation measures adopted as part of the basin phosphorus plan will be considered to be in compliance with the in-lake phosphorus criteria for all permitting and other regulatory purposes.

## New York

New York State currently has narrative, rather than numeric, eutrophication criteria applicable to Lake Champlain. However, the New York State Department of Environmental Conservation has recently initiated a rule-making procedure for the purpose of establishing numeric phosphorus criteria for lakes. The criteria would take into account the role phosphorus has in reducing lake transparency and increasing levels of algae and rooted aquatic plants. The phosphorus criteria could be lake-specific and based on levels necessary to support the prescribed best use of the water body.

Effluent standards based on best treatment technology for point sources within lake watersheds are also part of the New York proposed rule, as discussed in more detail below. The overall purpose of the rule is to establish a maximum allowable cumulative loading of phosphorus within lake watersheds.

## Québec

The Québec Ministry of the Environment has established a general numeric criterion of 0.020 mg/l of total phosphorus applicable to all lakes and another one of 0.030 mg/l for streams (Québec Ministry of the Environment, Water Quality Criteria, October 1990). These criteria were set to eliminate nuisances caused by algae proliferation in water bodies, and to protect values and uses including aquatic life, recreational water contact activities, raw public water supplies, and aesthetics.

By using these criteria for point source pollution control, the Ministry of the Environment determines the levels of residual total phosphorus that can be released into the receiving waters without creating adverse effects, locally or at the watershed scale.

The 0.020 mg/l lake criterion was set mainly to prevent local nuisances beyond a tolerable mixing zone. For lakes where there is a need to measure and to predict the phosphorus loading, the Ministry of the Environment developed in 1979 a methodology defining a "permissible loading" and a "critical loading". The permissible loading represents the loading level that could be permitted without the lake phosphorus concentration exceeding the oligotrophic state (mean value of 0.010 mg/l of total phosphorus in the lake at spring turnover). The critical loading defines the level above which a lake could be characterized as eutrophic (when the mean value exceeds 0.020 mg/l of total phosphorus at the spring turnover).

## Water Quality Criteria Summary

While New York, Québec, and Vermont have taken somewhat different approaches to lake water quality criteria in the past, their policies appear to be converging. All three jurisdictions have either adopted or proposed a numeric phosphorus criterion approach to the management of eutrophication in Lake Champlain. The New York proposed lake phosphorus criteria rule is potentially compatible with the Vermont approach for Lake Champlain since both involve numeric, in-lake values derived from lake-specific considerations to protect recreation and aesthetics, or other "best uses" of the lake. The Québec general lake phosphorus guideline of

0.020 mg/l is similar to, but not identical with, the Vermont criterion of 0.025 mg/l for Missisquoi Bay.

### **Lake Champlain Phosphorus Diagnostic-Feasibility Study**

In 1989 the States of Vermont and New York jointly began a large phosphorus study of Lake Champlain, funded by the U.S. Environmental Protection Agency Clean Lakes Program as a diagnostic-feasibility study. The purpose of this bi-state effort is to measure phosphorus loadings to Lake Champlain from all tributaries, wastewater discharges, and other major sources, and to develop a whole-lake phosphorus water quality model for Lake Champlain. The model will be used to develop an optimal phosphorus load allocation plan between point and nonpoint sources, and between individual river basins in New York, Québec, and Vermont in a manner that attains specific in-lake phosphorus concentration objectives.

The study is scheduled for completion later in 1993, at which time a recommended set of river-mouth phosphorus load allocation targets will be specified for the entire drainage basin. In order to conduct this quantitative modeling and load allocation procedure, numeric in-lake phosphorus concentration objectives must first be defined, because these in-lake water quality goals are what ultimately drive the allocation process. Therefore, the successful completion of the Lake Champlain Phosphorus Diagnostic-Feasibility Study depends on the mutual acceptance of a consistent set of in-lake numeric phosphorus criteria between New York, Québec, and Vermont.

### **Point Source Phosphorus Policies**

#### Vermont

Vermont has had a statutory phosphorus detergent ban in effect since 1978 which prohibits the sale of household cleansing products containing more than a trace amount of phosphorus, with some exceptions. The phosphorus detergent ban was estimated to have reduced the phosphorus loads discharged from municipal wastewater treatment facilities by about 40%.

A Vermont statute enacted at the same time as the phosphorus detergent ban also required designated wastewater treatment facilities discharging to Lake Champlain or its tributaries to remove phosphorus down to the 1.0 mg/l level in the effluent. About 14 municipal treatment plants and several industrial wastewater treatment facilities in the Vermont portion of the Lake Champlain basin are either currently operating or under construction to achieve the 1.0 mg/l limit.

Vermont Water Quality Standards adopted in 1991 require that "there shall be no significant increase over currently permitted loadings" in Lake Champlain. As a result, Vermont wastewater treatment facilities undergoing expansion have been required to maintain annual phosphorus loadings at their existing levels or lower.

A new phosphorus discharge statute was adopted by Vermont in 1992 establishing a basin-wide effluent limit of 0.8 mg/l for all discharges larger than 200,000 gallons per day, except for

aerated lagoon facilities which were exempted based on cost-effectiveness considerations. This requirement applies to about 28 municipal wastewater treatment facilities in the Lake Champlain basin, including those already required to remove phosphorus to 1.0 mg/l under the previous statute. Implementation of this new requirement will reduce design phosphorus loads from these plants by 118 metric tons per year. The total construction cost of \$3.6 million is to be 100% state funded. This program will be implemented gradually as state funding is provided over the next several years.

### New York

The New York State Department of Environmental Conservation Division of Water issued a Technical and Operational Guidance Series document in 1988 concerning phosphorus removal requirements for discharges in lake watersheds. This guidance document recommends that all new discharges in a lake watershed be required to implement "best treatment technology" for phosphorus removal, which includes sub-surface disposal wherever possible, and chemical treatment if necessary to remove phosphorus in the effluent to a level of 0.5-1.0 mg/l, depending on the size of the facility. Existing facilities undergoing flow expansion are required to remove phosphorus in a manner that maintains current loadings. Existing facilities not undergoing a flow expansion are required to remove phosphorus if the need is demonstrated through a special study or analysis. The lake phosphorus criteria rule-making procedure recently initiated by the New York State Department of Environmental Conservation would formalize into regulation effluent phosphorus removal requirements such as those contained in the 1988 technical guidance document.

New York State has had a statutory phosphorus detergent ban in effect since 1973.

### Québec

The construction of wastewater treatment facilities is recent in Québec. The main efforts were initiated in 1978 when the government of Québec launched a province wide program. Some \$7.4 billion will have been invested for the construction of proper secondary wastewater treatment plants by the time the program is completed in a few years.

In Québec, load allocations for municipal wastewater treatment plants are site specific and are based on the particular uses and constraints of the receiving waters.

In the Missisquoi Bay watershed, besides the removal of other parameters such as biological oxygen demand and fecal coliform bacteria, all municipal and industrial treatment plants currently operating or to be constructed are designed to achieve maximal phosphorus removal. The current objective in this watershed is an effluent concentration level of 0.8 to 1.0 mg/l of total phosphorus for all facilities, regardless of their size. Two of the main dischargers in the Québec portion of the Missisquoi Bay watershed, the City of Bedford and the food processing plant owned by "Les Aliments Carrière (both located in the Pike River watershed) are now treating their effluent. They share the same discharge outlet, and year round phosphorus removal is required to attain a 1.0 mg/l effluent concentration limit.

Federal regulations on phosphorus concentration in laundry detergents have been in effect in Canada since 1973. The *Regulations Respecting the Concentration of Phosphorus in Laundry Detergents* (SOR/89-501) specify that the concentration of phosphorus in any laundry detergent used in Canada shall not exceed 5 percent by weight expressed as phosphorus pentoxide, or 2.2 percent by weight expressed as elemental phosphorus.

### Point Source Summary

New York, Québec, and Vermont differ somewhat in their approach to point source phosphorus control in the Lake Champlain drainage basin. The Vermont statutory 0.8 mg/l limit applies to a selected set of larger facilities, both existing and new plants, but exempts other plants because of cost-effectiveness considerations. The New York technical guidance document applies strict controls to all new facilities, including sub-surface disposal requirements where feasible. However, existing facilities in New York are required only to maintain current phosphorus loadings without increase. Québec is somewhat behind Vermont and New York in the construction of sewers and treatment plants for its municipalities, but now has an active construction program in the Missisquoi Bay watershed that will install phosphorus removal at all facilities to a 0.8-1.0 mg/l effluent level, regardless of plant size, within the next few years. Phosphorus detergent bans are in effect in all three jurisdictions.

## **Nonpoint Source Phosphorus Policies**

### Vermont

The reduction of agricultural nonpoint source pollution in Vermont, to date, has been a voluntary program based largely on federal cost share incentives and the landowners' desire to have a positive impact on natural resources. The program has involved a cooperative effort between a variety of federal, state, and local agencies and a substantial investment of public and private resources.

The planning and implementation of the state nonpoint source control strategy began officially in the mid-1970's with the Vermont 208 Agricultural Runoff Committee. Since then, the process of identifying problems and targeting priority watersheds for treatment has continued, and the watershed priority list has been used by the federal agencies in planning and implementing water quality projects, the majority of which have been in the Lake Champlain Basin. More recently, the Vermont Department of Environmental Conservation prepared a Nonpoint Source Assessment and Management Plan together with a State Clean Water Strategy to refine the list of priority targeted watersheds for federal nonpoint assistance programs. It is expected that these priorities will be further re-directed as the results of the Lake Champlain Phosphorus Diagnostic-Feasibility Study and its river-mouth phosphorus load allocation becomes available.

Act 278 of the 1990 Legislative Adjourned Session required the Commissioner of Agriculture to study the need for and use of best management practices (BMP's) to reduce agricultural nonpoint source pollution, and to report to the legislature in January 1993. The Commissioner established a work group which recommended a three tiered program that

combines the voluntary implementation of specific land treatment practices at a reasonable public cost with the mandatory implementation of basic practices at no public cost. The three tiers of the recommended program are:

1. Basic Conservation Practices (BCP's) mandatory on all farms at no cost to the state.
2. Statewide income tax credit incentives for voluntary application of specific practices that have water quality benefits.
3. State and federal cost-sharing for voluntary implementation of BMP's in targeted watersheds.

Act 261 of the 1992 legislature delegated management of all agricultural nonpoint programs from the Department of Environmental Conservation to the Department of Agriculture.

### New York

The Federal Water Quality Act of 1987 focused attention and priority on the development and implementation of nonpoint source control programs. Section 319 of the Act required states to prepare an Assessment Report identifying water bodies affected by nonpoint source pollution, determining categories of nonpoint sources that are significant problems in the state, and listing state programs available for the control nonpoint source pollution. States were also required to prepare a Management Program which explained how they planned to deal with the source categories causing the major problems.

The New York assessment report was approved by the U.S. Environmental Protection Agency in July 1989, and the Management Program was approved in January 1990. The report was based on the Department of Environmental Conservation existing database of water quality problems.

The Division of Water has maintained since 1982 the Priority Water Problem List, a list of surface water bodies whose use is impaired. This listing is used to guide the administration of water management programs. The latest update of the Priority Water Problem List in 1991 revealed that over 90 percent of the water quality problems in the state are caused by nonpoint sources. Impaired water bodies are ranked from high to low priority considering their designated use and other factors. To be regarded as a problem, the classified use of a surface water body must fall in one of the following four impact categories: (1) precluded, (2) impaired, (3) stressed, or (4) threatened. Precluded use denotes the most severe impacts, while threatened use denotes the least severe impacts. For a statewide listing of all affected water bodies, refer to the Priority Water Problem List published by the Department of Environmental Conservation Bureau of Monitoring and Assessment.

Federal regulations published on November 16, 1990 have broadened the scope of activities that require discharge permits. "Stormwater discharges associated with an industrial activity" and certain "municipal separate storm sewer discharges" now require a stormwater discharge permit. In New York State, responsibility for implementing these federal regulations rests with the state, specifically through the State Pollutant Discharge Elimination System (SPDES).

There are eleven types of industrial activities defined in 40 CFR section 122.26(b)(14) for which stormwater permits are required. The list includes: construction activities, hazardous waste treatment of storage facilities, solid waste management facilities, electric power generating facilities, transportation facilities, sewage treatment works, and certain Standard Industrial Classifications. Stormwater discharges associated with industrial activity may include those which are conducted by government (i.e. government sponsored construction activities and government operation of certain defined industrial facilities such as landfills or sewage treatment plants). The federal stormwater regulations were published in the Federal Register on November 16, 1990 and have been revised since then (see 55 F.R. 47990, 56 F.R. 12098, 56 F.R. 56548, and 57 F.R. 11394).

The New York State Nonpoint Source Management Program, approved by the E.P.A. in 1990, aims to control nonpoint source pollution through proper land management. It relies on the use of financial incentives, voluntary compliance, and regulation to bring about change. The Management Plan includes:

1. A watershed planning process and guidelines for setting priorities in and among watersheds;
2. Recommended control measures for identified categories of nonpoint source pollution;
3. A four year implementation schedule to meet Section 319 of the 1987 Water Quality Act calling for a schedule to carry out the objectives of the Management Plan;
4. Potential sources of funding for implementation including federal and state grants and low interest loans from the state water pollution control revolving fund;
5. A method for reviewing federal activities to ensure consistency with state nonpoint source goals.

In 1990, the New York State Nonpoint Source Coordinating Committee was created to exchange information, coordinate nonpoint source efforts, and review water quality needs and proposed projects. It is co-chaired by the Department of Environmental Conservation and the New York State Soil and Water Conservation Committee.

Also in 1990, the New York Management Practices Task Force was established to help develop catalogs of management practices for controlling nonpoint source pollution for each of the identified categories. Eight categories of nonpoint sources have been identified for which management practices are being developed. These include agriculture, silviculture, mining, roadway maintenance, construction/development, streambank erosion, urban/stormwater runoff, and chemical and bulk storage. Two categories have already been addressed extensively. The Department of Environmental Conservation Bureau of Technical Services and Research has published a manual "Controlling Agricultural Nonpoint Source Water Pollution in New York State" which provides guidance on best management practices to reduce nonpoint source pollution from agricultural sources. The Department of Environmental Conservation Bureau of Water Quality Management has published a manual "Reducing the Impacts of Stormwater Runoff

from New Development" which provides guidance on best management practices to reduce urban/stormwater runoff.

In 1989, the New York State Legislature passed a nonpoint source pollution control law which authorized two matching grants programs for planning and implementation of nonpoint source pollution control and abatement projects. One, administered by the Department of Environmental Conservation helps municipalities address non-agricultural sources such as urban runoff, erosion and sedimentation from construction, and land disposal of wastes. The other, administered by the New York State Soil and Water Conservation Committee provides cost-share assistance to the agricultural community to install management practices. However, neither of these grants programs have ever been funded.

Realizing that nonpoint source pollution is best controlled at the watershed level, the Department of Environmental Conservation and the New York State Soil and Water Conservation Committee are working together to encourage counties throughout the state to develop county water quality strategies with a goal of integrating nonpoint source pollution control programs at various government levels into a coordinated interagency effort at a local level. This concept of a "bottom up" approach to tackling nonpoint source pollution problems at the local level has been well embraced across the state. In conjunction with this effort, the Department of Environmental Conservation and the New York State Soil and Water Conservation Committee has, through contracts with the Water Resources Institute at Cornell University and the U.S. Soil Conservation Service, developed a Water Quality Planning Guide to help communities design programs to reduce nonpoint source pollution. The guide provides assistance with identifying problems and their sources, setting priorities, and examining alternative solutions.

### Québec

Although Québec has been involved in nonpoint source pollution control since 1972 by means of the Québec Environmental Quality Act, the provincial action intensified in the 1980's with the introduction of a by-law intended to prevent the water pollution produced by livestock operations (*Regulation Respecting the Prevention of Water Pollution in Livestock Operations*). This regulation was intended to discourage farmers from diverting manure directly into a stream or spreading excessive amounts of manure on their fields. The main incentive for compliance is steep fines. In September 1984, complementary rules of conduct were adopted for the construction of manure storage facilities (Directive No. 016). A moratorium was also passed in 1987 to forbid new livestock operations intended for the raising of hogs in the L'Assomption watershed.

By 1987, only about 7,000 farms out of 40,000 in the province were equipped with proper manure storage facilities. To encourage farmers to proceed more rapidly to better manure management, the Ministry of the Environment and the Ministry of Agriculture, Fisheries, and Food created a joint program in 1988. This grant program (*Programme d'aide à l'amélioration de la gestion des fumiers*) will generate an estimated spending of \$535 million in a decade, of which \$388 million will come from direct governmental funding. The main goals of this program are:

- to reduce water and groundwater pollution;
- to reduce air pollution;
- to reduce the volume of the liquid content of manure during storage;
- to promote the rational use of manure as a fertilizer and to encourage farmers to adopt better agricultural practices, such as spring and summer field spreading;
- and to facilitate the treatment of the wastewaters of dairy farms.

Recently, these two ministries announced an important agricultural stream protection strategy (*Stratégie de protection des cours d'eau en milieu agricole*) intended to reduce significantly the pollution associated with agricultural activities that jeopardize the quality of aquatic and shoreland ecosystems. One of the main goals of this new strategy is a 50% reduction of pollutants such phosphorus, nitrogen, and pesticides in priority watersheds, including the Richelieu River basin.

### Nonpoint Source Summary

New York, Québec, and Vermont rely primarily on voluntary programs with government cost-sharing for the control of nonpoint source nutrient pollution. Québec is the only jurisdiction where a statute actively enforced by fines now exists to prevent the most severe forms of agricultural nutrient pollution such as direct manure runoff. The Vermont Legislature will be considering a proposal to make certain basic agricultural conservation practices mandatory, and to encourage other voluntary best management practices by means of tax incentives and state and federal cost-sharing grants in specifically targeted watersheds.

## **DISCUSSION**

### **Need for Numeric Criteria**

There are several reasons why the establishment of a consistent set of numeric, in-lake phosphorus water quality criteria between New York, Québec, and Vermont is an important and necessary step for the effective management of eutrophication in Lake Champlain.

1. Numeric criteria provide a quantitative yardstick by which progress and compliance can be measured objectively by monitoring.
2. Numeric criteria establish a finite assimilative capacity for multiple phosphorus sources having cumulative lakewide impacts. This aspect is particularly important in Lake Champlain where no single phosphorus source is dominant by itself, but where excessive eutrophication is the result of the cumulative impact of many individually small phosphorus sources, both point and nonpoint. In contrast, previously existing narrative water quality criteria have generally been applied on a case-by-case basis for individual discharge permits with respect to local impacts only, and with no consideration of whole-lake cumulative impacts.

3. Numeric criteria support a quantitative loading allocation process by which basin-wide reductions can be achieved in a rational and equitable manner.
4. Numeric criteria, when used with lake loading models, identify specific phosphorus loading reduction targets (e.g. at each tributary mouth). These loading targets will highlight the need for nonpoint source reductions in the Lake Champlain Basin, and could galvanize management efforts by defining a simple and understandable water quality goal to be achieved. In contrast, previously existing narrative eutrophication criteria provide no specific loading targets, and cannot define a specific endpoint when management programs have achieved their goal.

The environmental management agencies in New York, Québec, and Vermont have all either adopted or proposed a numeric in-lake phosphorus criterion approach to eutrophication management in Lake Champlain and other lakes, for many of the reasons listed above. The issue is therefore not whether a numeric approach is desirable for Lake Champlain, but rather what specific criteria values should be accepted and what regulatory form they should take so that a consistent set of management goals can be established between the three jurisdictions.

With the recently initiated lake phosphorus criteria rule-making process in New York, an excellent opportunity now exists to establish a consistent set of in-lake criteria for Lake Champlain between New York, Québec, and Vermont. The normal three-year water quality standards revision process in Vermont and the New York environmental rule-making procedure provide good mechanisms to work toward a consistent set of criteria values for those lake segments held in common. With joint participation and coordination of these processes among the three jurisdictions, it should be possible to accomplish this purpose.

### **Need for Interim Criteria**

There is an immediate need for the joint acceptance of an interim set of numeric phosphorus criteria so that current eutrophication management efforts can continue in a coordinated manner. As discussed earlier, the successful completion of the Vermont and New York Lake Champlain Phosphorus Diagnostic-Feasibility Study will require the prior definition of numeric, in-lake phosphorus criteria in order to accomplish the modeling and basin-wide load allocation objectives. The load allocation results are needed to establish priorities and goals for major point and nonpoint source phosphorus control programs in the basin.

It is therefore recommended that the Lake Champlain Steering Committee endorse the phosphorus criteria values specified in the Vermont Water Quality Standards as an interim set of joint management goals for the entire lake, subject to later modifications as a result of the New York rule-making procedure and any subsequent revisions made to the Vermont and Québec criteria based on the considerations discussed below. These criteria should be extended to include New York and Québec waters as indicated in Table 1, with segment boundaries as shown in Figure 2. The criteria should be applied as summer or annual mean values in central, open-water regions of each lake segment. These interim criteria should be used as a starting point in the process of formalizing a consistent set of criteria in Vermont and New York, and to guide on-going eutrophication management programs in all three jurisdictions in the meantime.

**TABLE 1**

**LAKE CHAMPLAIN**

**PROPOSED INTERIM TOTAL PHOSPHORUS CRITERIA**

<u>LAKE SEGMENT</u> <sup>1</sup>	<u>PROPOSED PHOSPHORUS CRITERION (<math>\mu\text{g/l}</math>)</u>	<u>EXISTING PHOSPHORUS CONCENTRATION (<math>\mu\text{g/l}</math>)</u> <sup>2</sup>
Main Lake	10	15
Malletts Bay	10	11
Shelburne Bay	14	17
Burlington Bay	14	15
Cumberland Bay <sup>3</sup>	14	20
Northeast Arm	14	18
Isle LaMotte	14	18
Otter Creek	14	19
Port Henry	14	16
St. Albans Bay	17	37
Missisquoi Bay	25	38
South Lake A	25	36
South Lake B	25 <sup>4</sup>	52

<sup>1</sup> Segment boundaries are defined Figure 2.

<sup>2</sup> 1979-1992 mean summer values recorded by the Vermont Lay Monitoring Program.

<sup>3</sup> New segment proposed within New York waters.

<sup>4</sup> An interim criterion of 25  $\mu\text{g/l}$  is recommended for the entire South Lake, which differs from the 54  $\mu\text{g/l}$  criterion specified for the South Lake B segment in the Vermont Water Quality Standards.

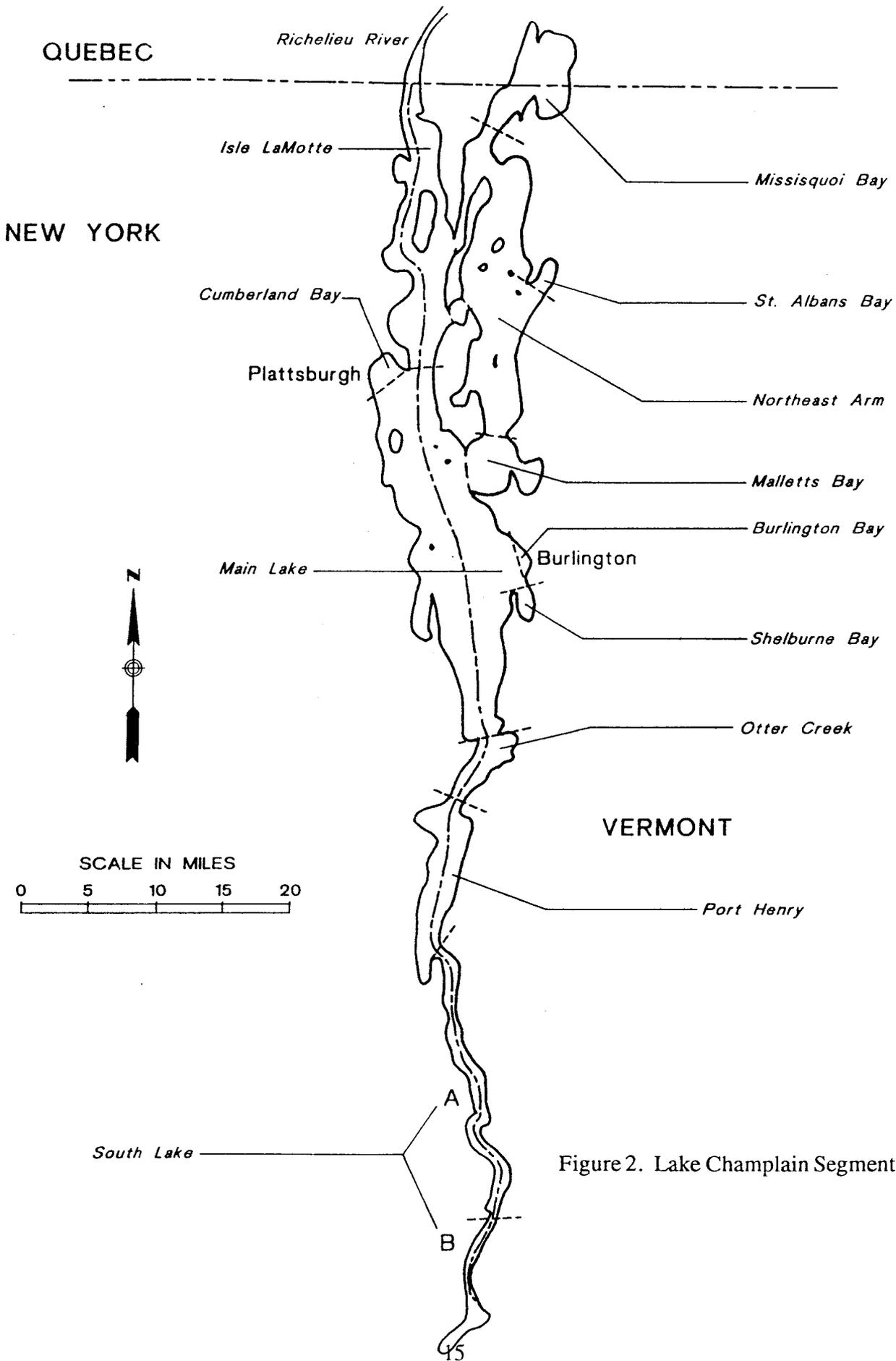


Figure 2. Lake Champlain Segments.

## **Modifications to the Criteria**

The interim criteria listed in Table 1 were based on an objective analysis of user survey and water quality data obtained specifically for Lake Champlain. The supporting data and analysis therefore provide a sound basis for establishing criteria to protect human use and aesthetic values of the lake. However, these values were not derived with specific consideration of ecosystem impacts of various phosphorus levels, and subsequent modifications of these criteria should weigh both human use and ecosystem values of the lake. The results of bioenergetics modeling studies sponsored by the Lake Champlain Basin Program may provide a scientific basis for considering phosphorus impacts on the lake ecosystem.

Numeric phosphorus criteria in Lake Champlain should reflect water quality conditions that are realistically attainable through management efforts. The recommended interim criteria given in Table 1 are, in most cases, substantially lower than the existing levels in the lake. The modeling results from the Lake Champlain Phosphorus Diagnostic-Feasibility Study and other research may reveal areas of the lake where phosphorus loading reductions to achieve these interim criteria are not practically attainable, or where slightly modified criteria values could be much more cost-effectively attained. The modeling and load allocation results should be considered in making future revisions to these interim values.

## **Application of the Criteria**

The interim phosphorus criteria given in Table 1, and formal state water quality criteria that may be adopted or revised in the future, should be achieved through compliance with broadly applied point and nonpoint source phosphorus policies and programs. The criteria should not be made directly enforceable against individual discharges which are in compliance with the applicable basin plan or general policy for their particular source type, even if the in-lake criteria are not yet achieved because of other uncontrolled loading sources. In this way, the impact of the new phosphorus criteria on existing permitting and other regulatory procedures should be minor and workable.

The interim criteria should be used to develop a recommended basin-wide phosphorus load allocation as part of the Lake Champlain Diagnostic-Feasibility Study. This allocation may serve as a basis for the nutrient management section of the Comprehensive Pollution Prevention, Control, and Restoration Plan being developed by the Lake Champlain Management Conference. Continued cooperation between New York, Québec, and Vermont during the allocation development process will be necessary to insure that decisions made as part of the allocation procedure are mutually acceptable. It may not be possible, however, to apply phosphorus load allocations based on interim criteria to modify wastewater discharge permits in New York until the criteria are formally adopted by rule in New York.

## **Point and Nonpoint Source Programs**

A review of existing point and nonpoint source phosphorus control policies in New York, Quebec, and Vermont has indicated that many similarities exist between the three jurisdictions. Some policy differences remain in the point source area, however, and there is opportunity for further cooperation. The ultimate goal of our joint management of eutrophication in Lake

Champlain should be for each jurisdiction to assume a shared and equitable portion of the cost and effort of achieving mutually agreed upon in-lake water quality targets. Once a general phosphorus load allocation plan is agreed upon for point and nonpoint sources in New York, Québec, and Vermont, the issue of consistent point and nonpoint source programs should be revisited by the Lake Champlain Steering Committee to insure that these burdens are shared fairly across the basin.

## **RECOMMENDATIONS**

1. The Lake Champlain Steering Committee should endorse the numeric, in-lake phosphorus criteria given in Table 1 as interim management goals until a consistent set of state water quality criteria can be formalized by rule in New York and Vermont. These interim criteria should be used to direct a basin wide phosphorus load allocation between point and nonpoint sources in New York, Québec, and Vermont using the data and modeling capability developed by the Lake Champlain Phosphorus Diagnostic-Feasibility Study.
2. The New York State Department of Environmental Conservation should proceed with its rule-making procedure to establish numeric eutrophication criteria for lakes, including Lake Champlain. Lake water quality standards rule-making in New York and Vermont should be conducted cooperatively with participation from the other jurisdictions in order to promote consistency in the numeric criteria that are established for Lake Champlain.
3. Modifications to the interim phosphorus criteria listed in Table 1 should be made if necessary in each jurisdiction as new information becomes available. Specifically, research results on ecological effects of specific phosphorus values in Lake Champlain should be used to derive criteria that provide for both a healthy ecosystem and sustainable human use and enjoyment of the lake. The criteria should also be modified if the results of modeling and load allocation studies indicate that certain values are not practically attainable through reasonable phosphorus management efforts.
4. The Lake Champlain Steering Committee should re-visit the issue of consistent point and nonpoint source management policies between the three jurisdictions when the modeling and phosphorus load allocation recommendations become available. The goal should be to insure that the social and economic burden of achieving the phosphorus load reduction targets is shared equitably across the basin.
5. The Lake Champlain Steering Committee should endorse these recommendations by executing the attached Agreement.



# NEW YORK - QUÉBEC - VERMONT

## WATER QUALITY AGREEMENT: IN-LAKE PHOSPHORUS CRITERIA

### Introduction

The following Water Quality Agreement was developed in accordance with the **Memorandum of Understanding on Environmental Management of Lake Champlain** that was officially adopted by the states of New York and Vermont and the province of Québec on August 23, 1988. The Water Quality Agreement was developed to establish a consistent approach to phosphorus management in Lake Champlain.

### Purpose and Background

The states of New York and Vermont and the province of Québec recognize the importance of cooperation on the improvement of water quality in Lake Champlain. The purpose of this agreement is to establish numeric, in-lake phosphorus criteria as interim management goals until a consistent set of state water quality criteria can be formalized by rule in New York and Vermont. These interim criteria will be used to direct a basin-wide phosphorus load allocation between point and nonpoint sources using information from the Lake Champlain Phosphorus Diagnostic-Feasibility Study.

### Water Quality Agreement

1. New York, Québec, and Vermont agree to endorse the numeric, in-lake phosphorus criteria given in Table 1 as interim management goals until a consistent set of state water quality criteria can be formalized by rule in Vermont and New York.
2. The interim criteria given in Table 1 will be used to develop basin-wide phosphorus load allocations between point and nonpoint sources in New York, Québec, and Vermont using the data and modeling capability developed by the Lake Champlain Phosphorus Diagnostic-Feasibility Study and other related research. Phosphorus load allocations for Lake Champlain will be jointly developed by New York, Québec, and Vermont. Modifications of wastewater discharge permits in New York as a result of a phosphorus load allocation for Lake Champlain may not proceed until formal adoption of numeric criteria by rule in New York.
3. The New York State Department of Environmental Conservation will propose numeric eutrophication criteria applicable to Lake Champlain as part of its statewide rule-making procedure for lake water quality criteria.
4. Rule-making for lake water quality criteria in New York and Vermont will be conducted cooperatively, with participation from the other jurisdictions in order to promote consistency in the numeric criteria that are established for Lake Champlain.

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5. The Lake Champlain Steering Committee will re-visit the issue of consistent point and nonpoint source management policies between the three jurisdictions when modeling results and phosphorus load allocation recommendations become available.

**Agreement Revisions**

1. A Phosphorus Management Task Force will meet as needed to continue cooperative phosphorus management efforts and to recommend revisions or amendments to this agreement.
2. Modifications to the interim phosphorus criteria will be made if necessary as new information becomes available.
3. If staff changes occur, each jurisdiction will provide the new staff name(s) and telephone number(s) to the other in a timely manner.

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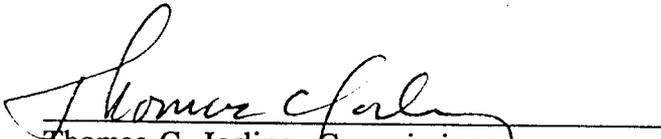
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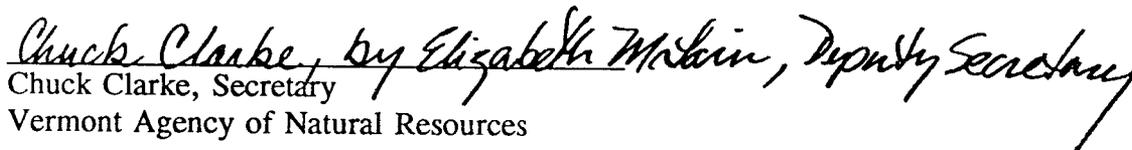
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Approved this 14<sup>th</sup> day of May, 1993.

  
Thomas C. Jorling, Commissioner  
New York State Department of Environmental Conservation

  
Pierre Paradis, Minister  
Québec Ministry on Environment

  
Chuck Clarke, Secretary  
Vermont Agency of Natural Resources

