Technical Report No. 17A

Economic Analysis of the Draft Final Plan for the Lake Champlain Management Conference

Executive Summary

Lake Champlain
Basin Program

Prepared by
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for
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ECONOMIC ANALYSIS OF THE DRAFT FINAL PLAN FOR THE LAKE CHAMPLAIN MANAGEMENT CONFERENCE

Executive Summary

Submitted to

THE LAKE CHAMPLAIN MANAGEMENT CONFERENCE

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Lake Champlain Basin Program Technical Reports

1. *A Research and Monitoring Agenda for Lake Champlain.* Proceedings of a Workshop, December 17-19, 1991, Burlington, VT. Lake Champlain Research Consortium. May, 1992.

2. *Design and Initial Implementation of a Comprehensive Agricultural Monitoring and Evaluation Network for the Lake Champlain Basin.* NY-VT Strategic Core Group. February, 1993.

3. (A) *GIS Management Plan for the Lake Champlain Basin Program.* Vermont Center for Geographic Information, Inc., and Associates in Rural Development. March, 1993.

   (B) *Handbook of GIS Standards and Procedures for the Lake Champlain Basin Program.* Vermont Center for Geographic Information, Inc. March, 1993.

   (C) *GIS Data Inventory for the Lake Champlain Basin Program.* Vermont Center for Geographic Information, Inc. March, 1993.

4. (A) *Lake Champlain Economic Database Project. Executive Summary.* Holmes & Associates. March 1993.

   (B) *Socio-Economic Profile, Database, and Description of the Tourism Economy for the Lake Champlain Basin.* Holmes & Associates. March 1993

   (B) *Socio-Economic Profile, Database, and Description of the Tourism Economy for the Lake Champlain Basin. Appendices.* Holmes & Associates. March 1993

   (C) *Potential Applications of Economic Instruments for Environmental Protection in the Lake Champlain Basin.* Anthony Artuso. March 1993.

   (D) *Conceptual Framework for Evaluation of Pollution Control Strategies and Water Quality Standards for Lake Champlain.* Anthony Artuso. March 1993.

5. *Lake Champlain Sediment Toxics Assessment Program. An Assessment of Sediment - Associated Contaminants in Lake Champlain - Phase 1.* Alan McIntosh, Editor, UVM School of Natural Resources. February 1994.

   Lake Champlain Sediment Toxics Assessment Program. An Assessment of Sediment - Associated Contaminants in Lake Champlain - Phase 1. Executive Summary. Alan McIntosh, Editor, UVM School of Natural Resources. February 1994.

6. *(A) Lake Champlain Nonpoint Source Pollution Assessment.* Lenore Budd, Associates in Rural Development Inc. and Donald Meals, UVM School of Natural Resources. February 1994.

   (B) Lake Champlain Nonpoint Source Pollution Assessment. Appendices A-J. Lenore Budd, Associates in Rural Development Inc. and Donald Meals, UVM School of Natural Resources. February 1994.

7. *Internal Phosphorus Loading Studies of St. Albans Bay. Executive Summary.* VT Dept of Environmental Conservation. March 1994.

(A) *Dynamic Mass Balance Model of Internal Phosphorus Loading in St. Albans Bay, Lake Champlain.* Eric Smeltzer, Neil Kamman, Karen Hyde and John C. Drake. March 1994.

(B) *History of Phosphorus Loading to St. Albans Bay, 1850 - 1990.* Karen Hyde, Neil Kamman and Eric Smeltzer. March 1994.

(C) *Assessment of Sediment Phosphorus Distribution and Long-Term Recycling in St. Albans Bay, Lake Champlain.* Scott Martin, Youngstown State University. March 1994.

8. *Lake Champlain Wetlands Acquisition Study.* Jon Binhammer, VT Nature Conservancy. June 1994.

9. *A Study of the Feasibility of Restoring Lake Sturgeon to Lake Champlain.* Deborah A. Moreau and Donna L. Parrish, VT Cooperative Fish & Wildlife Research Unit, University of Vermont. June 1994.

10. *Population Biology and Management of Lake Champlain Walleye.* Kathleen L. Newbrough, Donna L. Parrish, and Matthew G. Mitro, Fish & Wildlife Research Unit, University of Vermont. June 1994.

11. (A) *Report on Institutional Arrangements for Watershed Management of the Lake Champlain Basin. Executive Summary.* Yellow Wood Associates, Inc. January 1995.

(B) *Report on Institutional Arrangements for Watershed Management of the Lake Champlain Basin.* Yellow Wood Associates, Inc. January 1995.

(C) *Report on Institutional Arrangements for Watershed Management of the Lake Champlain Basin. Appendices.* Yellow Wood Associates, Inc. January 1995.

12. (A) *Preliminary Economic Analysis of the Draft Plan for the Lake Champlain Basin Program. Executive Summary.* Holmes & Associates and Anthony Artuso. March 1995

(B) *Preliminary Economic Analysis of the Draft Plan for the Lake Champlain Basin Program.* Holmes & Associates and Anthony Artuso. March 1995

13. *Patterns of Harvest and Consumption of Lake Champlain Fish and Angler Awareness of Health Advisories.* Nancy A. Connelly and Barbara A. Knuth. September 1995.

14. (A) *Preliminary Economic Analysis of the Draft Plan for the Lake Champlain Basin Program. Executive Summary - Part 2.* Holmes & Associates and Anthony Artuso. November 1995

(B) *Preliminary Economic Analysis of the Draft Plan for the Lake Champlain Basin Program - Part 2.* Holmes & Associates and Anthony Artuso. November 1995

15. *Zebra Mussels and Their Impact on Historic Shipwrecks.* Lake Champlain Maritime Museum. January 1996.

16. *Background Technical Information for Opportunities for Action: An Evolving Plan for the Future of the Lake Champlain Basin.* Lake Champlain Basin Program. June 1996

17. (A) *Executive Summary. Economic Analysis of the Draft Final Plan for the Lake Champlain Management Conference.* Holmes & Associates and Anthony Artuso. July 1996

(B) *Economic Analysis of the Draft Final Plan for the Lake Champlain Basin Management Conference.* Holmes & Associates and Anthony Artuso. July 1996

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NOTICE

The dollar amounts used in this report represent the best available data at the time of this research. The process of refining the benefits and costs of Lake Champlain restoration and protection activities should be an on-going process. A major purpose of this work was to develop economic analysis models and databases that are responsive to incremental changes in any of the benefit or cost estimates, and that can be easily up-dated with new data, information and scenarios as they become available.

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List of Abbreviations

AAP	Accepted Agricultural Practices
APA	Adirondack Park Agency
BMP	Best Management Practices
CAST	Council for Agricultural Science and Technology
CSO	Combined sewer overflows
cwt	100 lb measure, used for raw milk
FTE	Full time equivalent
GIS	Geographic Information System
GLC	Great Lakes Consortium
HK	Human capital
IMPLAN	Input-Output computer program (IMpact analysis for PLANing)
I-O	Input-Output
LCBP	Lake Champlain Basin Program
LCMC	Lake Champlain Management Conference
mg/L or mg/l	Milligrams per liter. .01 mg/l = 10 μg/l.
NRCS	Natural Resources Conservation Service (formerly the Soil Conservation Service)
NYSDEC	New York State Department of Environmental Conservation
NYSOPRHP	New York State Office of Parks, Recreation & Historic Preservation
O & M	Operation and Maintenance
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
ppm	Parts per million
SDWA	Safe Drinking Water Act
TAC	Technical Advisory Committee
μg/L or μg/l	Micrograms per liter. 10 μg/l = .01 mg/l.
USEPA	U.S. Environmental Protection Agency
UVM	University of Vermont
VTDEC	Vermont Department of Environmental Conservation
WTP	Willingness to pay
WWW	World Wide Web (Internet)

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ECONOMIC ANALYSIS OF THE DRAFT FINAL PLAN FOR THE LAKE CHAMPLAIN BASIN PROGRAM

1. Executive Summary

This document provides a detailed summary of the research methodology and major findings of the Economic Analysis project. For those who are interested in more detail on the variety of economic considerations incorporated into the analysis, the 300 report includes a 60 page Appendix of tables and supporting documentation. Readers wanting more information are also directed to the Lake Champlain draft Final Plan "Opportunities for Action" (referred to here as the "Plan") and the Plan's "Background Technical Information" report.

This summary begins with an introduction to the Lake Champlain planning process, followed by a discussion of the background benefit and cost data necessary to an accurate analysis of possible future benefits and costs related to draft Final Plan implementation. The next section is a detailed discussion of phosphorus control, with the measures to control phosphorus being a major component, and cost, of the Plan. The non-phosphorus actions are briefly discussed, followed by the major results from the IMPLAN analysis of the economic implications of Plan implementation for local economies in Vermont and New York. The remainder of the summary provides an overview of economic implications of high priority actions within the Plan, in an attempt to put the economic data in the context of local economies and recreational use of Lake Champlain. The summary concludes with a section on the cost of no action, and a glossary of economic terms and concepts.

The IMPLAN model is an economic tool for characterizing how a given economic activity actually impacts local economies at the county level. IMPLAN attempts to accurately model a county's economy by accounting only for funds that remain in the county as employee compensation or other direct payments at local businesses and industries. It also discounts governmental spending as less productive in local economies than private sector spending. The IMPLAN analysis carried out for this research found that Plan-related spending in the New York and Vermont Lake Champlain basin counties would equal or slightly exceed the actual economic benefit in those counties. Furthermore, if federal funds are available to fund 50% of the costs as is currently projected, then the local economic benefit would exceed state, local, private and non-profit spending on Plan-related activities.

1.1 Introduction

The Lake Champlain Management Conference (LCMC) was charged with creating a comprehensive plan for protecting and enhancing Lake Champlain and its watershed area. Since the beginning of its five year planning effort, the LCMC has been interested in integrating protection and enhancement of Lake Champlain with a vital economy for the future. The goal has been to promote economic strategies for the long-range economic future of the Region that are compatible with other goals contained in the Pollution Prevention, Control and Restoration draft Final Plan for Lake Champlain (i.e., "Opportunities for Action") and to tailor pollution prevention and control strategies for economic efficiency as well as environmental effectiveness. The Management Conference Vision Statement clearly relates those goals for the future of Lake Champlain by stating that the Plan:

> ...supports multiple uses -- including commerce, a healthy drinking water supply, fish and wildlife habitat, and recreation such as swimming, fishing, and boating. These diverse uses will be balanced to minimize stresses on any part of the Lake system. The Management Conference recognizes that maintaining a vital economy which values the preservation of the agriculture sector is an integral part of the balanced management of Lake Champlain....

In its deliberations and decision making, the LCMC evaluated each recommendation in the draft Final Plan on a wide variety of criteria, including the degree of public support, the reliability of possible funding sources, and the cost effectiveness of each element in addressing a particular Lake Champlain issue. It is in the realm of cost effectiveness, and the associated issue of the equitable distribution of costs, that this report provides information to the LCMC and the public.

This and prior research demonstrates the significant economic value of Lake Champlain as a tourism and recreation resource. In that respect, maintaining and improving the lake is important to a sustainable regional economy. While protecting Lake Champlain is among the major economic and social priorities of basin residents and communities, it is still only one among many priorities that include education, safety, health, jobs, etc. These research findings provide evidence substantiating the economic value to basin residents in protecting and restoring Lake Champlain. The economic analysis also provides decision makers and the public with the economic information necessary to develop a management program that is both cost effective and equitable.

It must be recognized that a full cost/benefit analysis requires that all probable economic costs and benefits of a given action be identified and quantified. That level of economic detail is currently unavailable for all the Plan elements. The goal for this work was to compile and analyze as much of the needed economic information as possible within the project time frame and budget. The study team sought to maximize the utility of this work by focusing on the recommendations that potentially pose the greatest costs, and offer the greatest benefits. In the process the study team created economic modeling tools that not only serve to illuminate costs, benefits, and cost efficiencies for the draft Final Plan, but that will prove useful during the Plan implementation process.

While the conciseness and finality of presenting a "bottom line" that would result from Plan implementation is very attractive, it is difficult if not impossible to account for many of the external influences on the economy of the Lake Champlain basin. For example, on the benefits side of the ledger, the weather, the Canadian exchange rate, and regional economic conditions all exert a strong external influence on the basin's tourism economy. On the costs side, it appears that increased federal funds may soon be available for nutrient management on farms as indicated by the 1996 Farm legislation. After a number of years of declining funding for farm programs, the local agricultural costs as modeled by this research may actually be reduced. Taking in the big picture, the overall value of Lake Champlain to the current quality of life, to future generations, and to increasing economic opportunities (e.g., attracting high tech industries) for Plattsburgh and Burlington are only a few of the economic considerations that are difficult to quantify and model.

1.2 Estimating Current Recreational Expenditures Related to Lake Champlain

In order to model the economic impact of projected water quality improvement resulting from implementation of "Opportunities for Action" a baseline for current Lake Champlain dependent economic expenditures had to be established. The study team took the conservative approach of estimating only water-based and Lake Champlain dependent recreational activity expenditures that occurred within three miles of Lake Champlain.

- **Water-based and Lake Champlain dependent recreational activity results in approximately $107 million in direct expenditures in the vicinity of Lake Champlain during the summer season.** The study team based that estimate on two approximate measures of recreational activity and expenditure. The number of lake users was based on average attendance levels at approximately 500 recreation sites within three miles of the lake, while the average expenditures per user were based on reported expenditures in the Lake Champlain area by families and groups engaged in various recreational activities including boating, swimming, camping, fishing, etc. The expenditure data were derived primarily from surveys of visitors carried out in the Lake Champlain basin in 1992 and 1993.
- **In addition to lake related direct expenditures by visitors, the study team estimated that seasonal residents who have summer homes around the lake spent approximately $16 million in the area on food, entertainment, arts & crafts, and other non-durable items during 1994.** Thus, the combined direct expenditures on Lake Champlain related tourism and recreation by both visitors and seasonal residents is estimated at $123 million. Approximately $77 million (63%) of the total expenditures occur in Vermont lake shore communities, and $46 million occurs in New York lake shore communities. This is believed to be a conservative estimate of Lake Champlain's current recreation value as it reflects only summer season use and is based on a 50% or less occupancy rate at public and commercial recreation sites within three miles of the lake.
- **The prime beneficiaries of Lake Champlain dependent economic activity are Chittenden and Grand Isle counties in Vermont, and Clinton and Essex counties in New York.** As shown in Table 1-1, approximately $29 million of the Vermont lake related expenditures occur in Chittenden County and $21 million in Grand Isle County. In New York, Lake Champlain visitors and seasonal residents spend approximately $21 million in Clinton County and $21 million in Essex County. Those would also be the counties receiving the majority of possible increases in recreational expenditures should the Plan be successfully implemented.

The values displayed above reflect direct expenditures as determined by the study team. IMPLAN analysis was used to determine the total direct, indirect, and multiplier effects of those expenditures. The total value added by tourism expenditures along the lakeshore was estimated at $97 million in Vermont and $57 million in New York, for a total economic impact of Lake Champlain related tourism expenditures of $154 million in 1992. It should be noted that recreational and aesthetic uses of the lake are valued by year-around residents living near the lake. These values are not all captured in expenditures at public facilities. Therefore additional economic value of Lake Champlain could be determined through property value research and travel-cost studies.

Table 1-1: Summary of Lake Champlain Dependent Visitor and Seasonal Resident Expenditures, by County

	Visitor Expenditures[1]	Seasonal Household Expenditures[2]	Total
New York Counties	$38,936,709	$6,906,462	$45,843,171
Clinton County	$20,112,116	$1,246,628	$21,358,744
Essex County	$17,502,051	$3,525,564	$21,027,615
Washington County	$1,322,542	$2,134,270	$3,456,812
Vermont Counties	$67,796,000	$9,353,282	$77,149,282
Grand Isle County	$18,043,990	$3,405,902	$21,449,892
Franklin County	$8,185,683	$2,037,826	$10,223,509
Chittenden County	$27,298,869	$2,055,686	$29,354,555
Addison County	$12,678,772	$1,564,536	$14,243,308
Rutland County	$1,588,685	$289,332	$1,878,017
Totals	$106,732,709	$16,259,744	$122,992,453

1. Visitor expenditure data based on 1992 and 1993 dollars.
2. Seasonal resident expenditure data based on 1994 dollars.

Holmes & Associates and Anthony Artuso 1996.

1.3 Establishing the Costs of Plan Implementation

While the total estimated costs of the various Plan proposed actions are outlined in "Opportunities for Action," the study team was expected to respond to concerns about the geographic distribution of costs. The LCMC and the interested public desired information on the economic impact of Plan implementation in New York, Vermont, and even in specific counties along the lake if possible. In response, the study developed cost distributions for each action item among New York, Vermont, and the Federal government based on our knowledge and information about fiscal and economic conditions around the lake. The cost distribution between Vermont and New York -- referred to here as their share of the cost -- is based on their respective share of the total basin economy. Vermont is allocated 71% of the costs and New York 29%.

The estimated proportion of each Action that will be federally funded is based on considerable study of Vermont's fiscal experience by the staff at Economic & Policy Resources, Inc. For example, the federal share for the Toxics actions is estimated at 80%, the federal share for the Nuisance Aquatics actions is 50%, and the federal share for the actions for Managing Recreation is 10%. The cost distributions are clearly reported in the tables and the text, allowing the estimates to be easily up-dated as new information becomes available.

1.3.1 Actions to Control Phosphorus

The Lake Champlain phosphorus control model developed as part of this project has four integrated components. The first section of the model is a detailed compilation of actual, permitted and projected point source flows and loadings, given current policies and assuming implementation of controls to achieve phosphorus discharge concentrations of either 0.8 mg/l and 0.5 mg/l at facilities with permitted flows greater than .2 mgd. Also included in this component of the model is the capital and operating cost of upgrading each treatment plant with a permitted flow of greater than 0.2 mgd to meet either a 0.8 mg/l and 0.5 mg/l discharge standard. This point source section of the model updates the information developed for the Diagnostic-Feasibility (D/F) Study with new estimates of capital and operating costs of point source upgrades. These estimates include the additional operating and maintenance costs required for sludge handling. The point source component of the model allows the user to calculate the costs and discharge reductions that would result from implementation of phosphorus control measures at any combination of facilities.

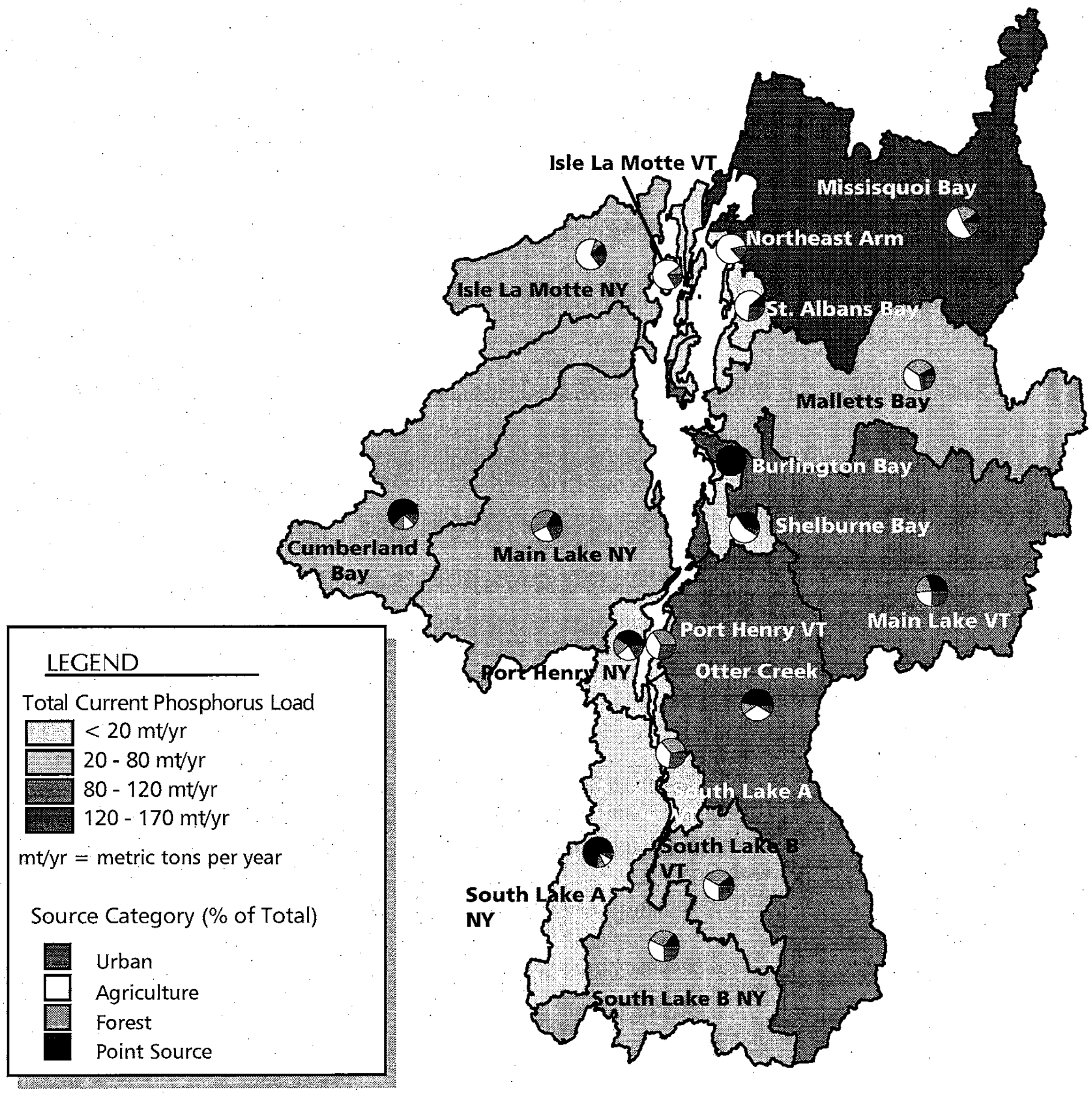
The revised version of the phosphorus control model developed for this study, also incorporates projections of point source flows through the year 2010 derived from town level population projections. Projections of treatment facility flows were calculated by identifying the town(s) served by each treatment facility and increasing the current flow by the percentage change in population. If the population served by the treatment facility was less than 100% of the population of the town(s) it serves, the current flow was increased to incorporate the projected population change in the service area and to reflect the assumption that by 2010 sewer service would be extended to the other sections of the service area until 100% of the permitted capacity of the treatment facility is utilized. This methodology may tend to underestimate future point source loads since it does not assume any increase in permitted point source flows and caps the projected flow of any treatment facility at its permitted flow. However, modifying this assumption would require more detailed analysis of treatment facility service areas which are beyond the scope of this project.

The second component of the model incorporates information on nonpoint source phosphorus loadings and control costs for each lake segment watershed. Starting with the total nonpoint source loads estimated in the Diagnostic Feasibility (D/F) Study, the relative phosphorus contributions of agriculture, urban and forest lands were estimated on the basis of current and projected land use data and estimated phosphorus exports rates of each land use.

The GIS specialists at Stone Environmental, Inc. (SEI) compiled the 1992 land use data from NRCS National Resource Inventory (NRI) database as the basis for estimating current non-point phosphorus loadings by land use. The results of the model run showing current phosphorus load information by lake segment watershed are shown in Map 1 in metric tons per year. In addition, the allocation of the total loads to each source of phosphorus (point source, urban, forest, or agriculture) is displayed.

SEI then used population projections to develop forecasted land uses for the year 2010. Those forecasted land uses were then used to help generate their contribution to the projected phosphorus loading for the year 2010 if no action on phosphorus control was taken, as shown in Map 2. Map 3 shows projected phosphorus loading for the year 2010 if Scenario 3 was implemented, as discussed below.

Lake Champlain Basin



MAP 1: Current Phosphorus Loads by Segment Watershed

20 0 20 40 Miles

Scale

Source: WRD, USGS, Albany, NY; NYUNITS coverage;
USGS, Concord, NH; VTBASIN coverage
Holmes and Artuso, 1996; Population and Phosphorus data
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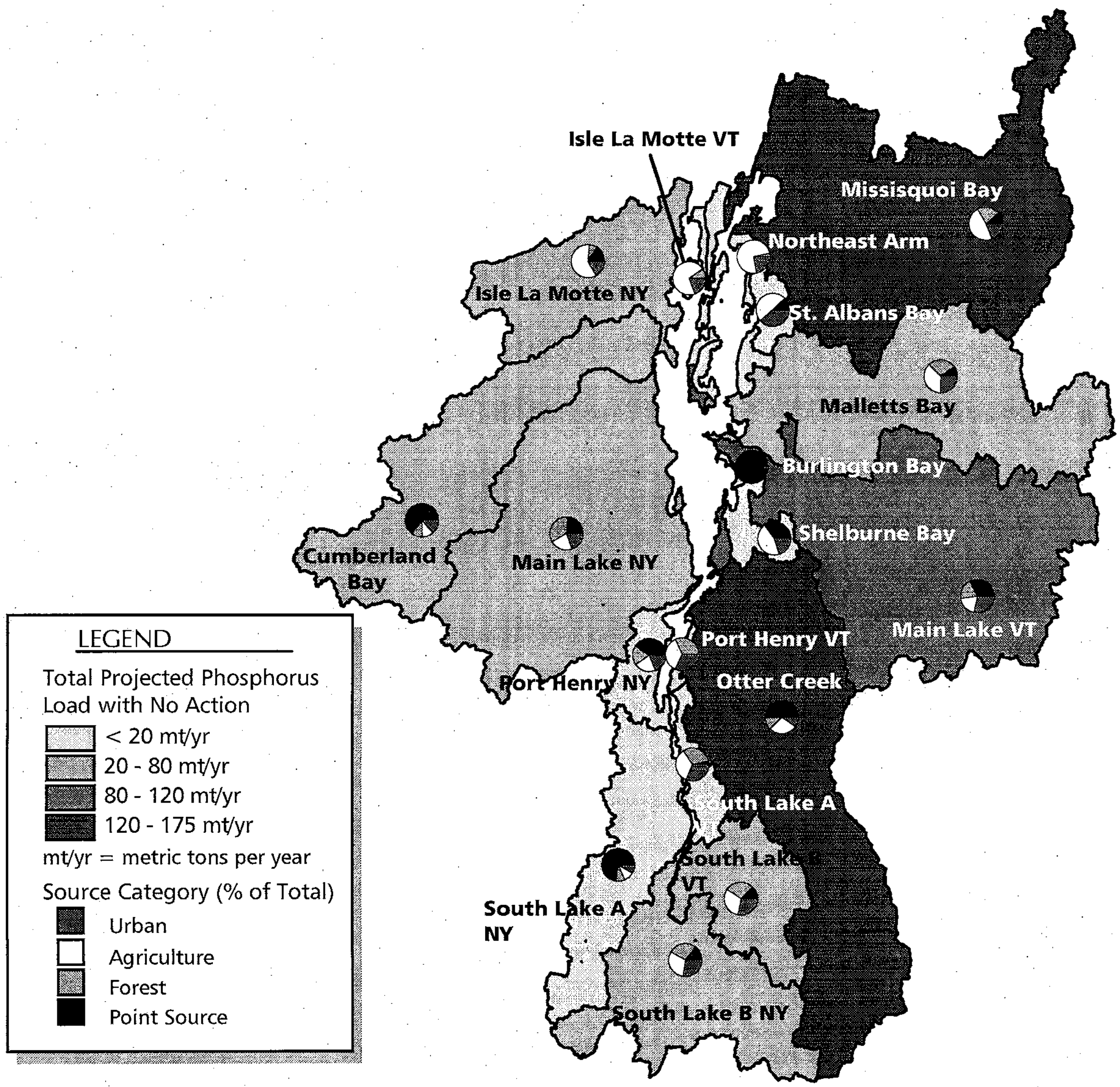
Lake Champlain Basin



MAP 2: Projected Phosphorus Loads with No Action 2010 by Segment Watershed

20 0 20 40 Miles
Scale

Source: WRD, USGS, Albany, NY; NYUNITS coverage
USGS, Concord, NH; VTBASIN coverage
Holmes and Artuso, 1996; Population and Phosphorus data
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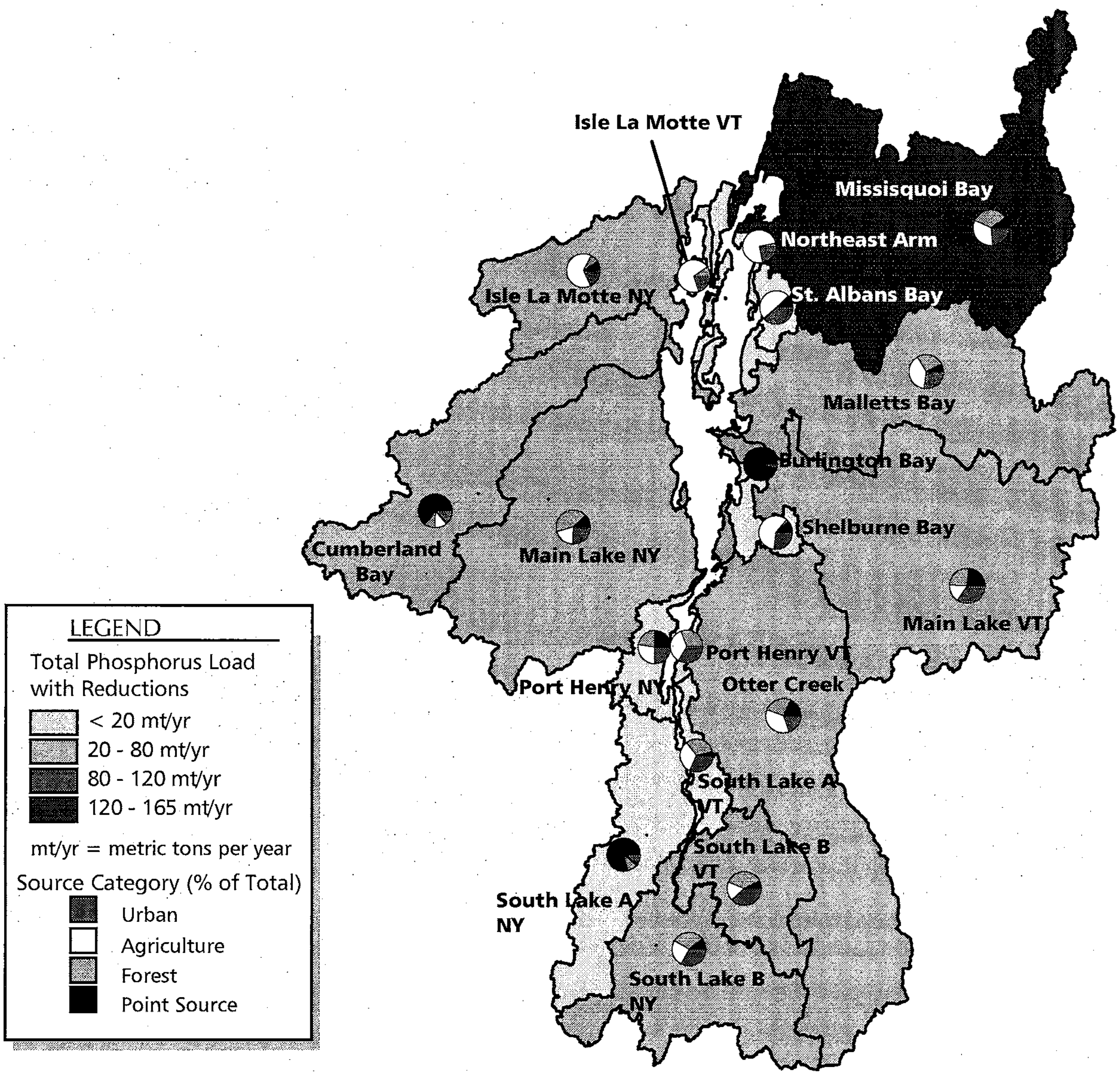
Lake Champlain Basin



MAP 3: Projected Phosphorus Loads with Reductions 2010 by Segment Watershed

20 0 20 40 Miles

Scale

Source: WRD, USGS, Albany, NY; NYUNITS coverage
USGS, Concord, NH; VTBASIN coverage
Holmes and Artuso, 1996; Population and Phosphorus data
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STONE ENVIRONMENTAL INC

The Economic Analysis Report presents several scenarios for Plan implementation, based on four alternatives for controlling phosphorus in the basin. In addition to the no action scenario, four phosphorus reduction strategies were evaluated using the phosphorus control model. A summary of the projected phosphorus control costs by scenario is presented in Table 1-2. It is important to note that the values for Quebec are based on best available data at this time and reflect the cost of achieving the goals set out in the New York, Vermont and Quebec 1993 Water Quality Agreement. Current research in the Quebec portion of the basin is on-going and any findings related to phosphorus should be incorporated into the model as they become available.

The first reduction strategy (Scenario 1) examines the cost of implementing what was previously referred to as policy option 2 in the first draft Plan (October, 1994). This option includes a point source phosphorus standard of 0.8 milligrams per liter (mg/l) for all facilities with permitted flow in excess of 0.2 million gallons per day (mgd) and then seeks to target nonpoint source controls in a cost-effective manner to achieve the in-lake phosphorus criteria.

The second phosphorus reduction strategy (Scenario 2) includes what was previously referred to as policy option 3 in the first draft Plan. This option includes a point source phosphorus standard of 0.5 mg/l for all facilities with permitted flow in excess of 0.2 mgd and then seeks to target nonpoint source controls in a cost-effective manner to achieve the in-lake phosphorus criteria. The third phosphorus reduction strategy allows for complete flexibility in targeting both point and nonpoint source controls to achieve the in-lake criteria most cost effectively. The final phosphorus reduction strategy (Scenario 4) that was examined involves no point source controls in New York and targeted point source controls in Vermont together with cost effective targeting of NPS controls in both New York and Vermont.

The third phosphorus reduction strategy (Scenario 3) was found to be most cost effective at meeting the phosphorus targeting goals. Under this point source and non-point source (NPS) targeting scenario, the total present value costs decline to $109.8 million per year which is equivalent to $7.1 million on an annualized basis. Only a few treatment facilities in New York would be targeted for phosphorus control measures under this cost-effective scenario. The initial run of the model found that targeting the following facilities was most cost effective: Great Meadows Correctional Center, Port Henry, Peru, and Lake Placid. However, more detailed cost estimates might indicate that targeting other New York facilities makes more sense. The findings of the model need to be considered in light of the specific situation and needs at each facility.

Scenario 3 includes continued implementation of agricultural NPS controls in the South Lake A, South Lake B, Otter Creek and Main Lake watersheds in both New York and Vermont. Approximately 25% of the costs of this phosphorus control strategy would be for point source controls and 75% would be for nonpoint source controls. Of the $7.1 million in total annualized control costs for this strategy, approximately $4.5 million or 63% would be for point and nonpoint source controls in Vermont, slightly less than $1 million or 13% would be for phosphorus controls in New York, and $1.7 million or 24% would be for phosphorus control measures in Quebec.

All of the phosphorus control strategies outlined above, with the exception of the 0.5 mg/l point source standard, rely heavily on nonpoint source controls. Even with a less stringent in-lake phosphorus target for Mississquoi Bay, 30-50% of the cost of the above scenarios is attributable to that watershed. In addition, phosphorus control costs in Mississquoi Bay are highly sensitive to changes in the in-lake phosphorus con-

Table 1-2: Summary of Lake Champlain Phosphorus Control Costs for Four Scenarios

	Scenario 1 .8 mg/l Point Source Standard ($ 000's)				Scenario 2 .5 mg/l Point Source Standard ($ 000's)				Scenario 3 Targeted Point Source Controls ($ 000's)				Scenario 4 No NYS Point Source Contrc		
	Total	Vermont	New York	Quebec	Total	Vermont	New York	Quebec	Total	Vermont	New York	Quebec	Total	Vermont	New York
Point Source Control Costs															
Capital	16,791	12,877	3,390	524	59,025	47,106	9,976	1,944	12,518	11,162	833	524	11,686	11,162	0
O&M	2,163	1,494	610	59	4,124	3,083	918	123	944	670	215	59	878	819	0
Present Value*	50,033	35,842	12,759	1,432	122,812	94,889	24,086	3,836	27,028	21,459	4,138	1,432	25,189	23,757	0
Annualized	3,255	2,332	830	93	7,989	6,173	1,567	250	1,758	1,396	269	93	1,639	1,545	0
Agricultural Nonpoint Source Control Costs															
Capital	50,951	29,654	5,251	16,046	35,000	17,045	2,006	15,949	53,106	30,652	6,408	16,046	57,717	34,318	7,353
O&M	2,295	1,335	236	723	1,576	768	90	718	2,392	1,380	289	723	2,599	1,546	331
Present Value*	78,385	45,621	8,078	24,686	53,847	26,223	3,087	24,537	81,701	47,157	9,858	24,686	88,796	52,797	11,312
Annualized	5,099	2,968	525	1,606	3,503	1,706	201	1,596	5,315	3,068	641	1,606	5,776	3,435	736
Urban Nonpoint Source Control Costs															
Capital	28,473	15,845	388	12,241	0	0	0	0	695	283	412	0	697	284	412
O&M	1,252	696	17	538	0	0	0	0	27	11	16	0	27	11	16
Present Value*	47,713	26,551	650	20,512	0	0	0	0	1,114	453	660	0	1,117	455	660
Annualized	3,104	1,727	42	1,334	0	0	0	0	72	29	43	0	73	30	43
Total Phosphorus Control Costs															
Capital	96,214	58,376	9,028	28,811	94,026	64,151	11,982	17,893	66,319	42,097	7,652	16,570	70,100	45,765	7,765
O&M	5,709	3,526	863	1,320	5,700	3,850	1,008	841	3,363	2,061	520	782	3,505	2,376	347
Present Value*	176,132	108,014	21,487	46,631	176,659	121,112	27,173	28,373	109,843	69,069	14,656	26,118	115,102	77,009	11,973
Annualized	11,458	7,026	1,398	3,033	11,492	7,879	1,768	1,846	7,145	4,493	953	1,699	7,488	5,010	779

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* Present value and annualized costs include capital and O&M expenses and assume time horizon of 30 yrs. with 5% real discount rate.
These values are based on computations made in the phosphorus control model and are estimates of the cost of reaching given phosphorus goals.
The data in model has been refined during 1995 and 1996 by staff at a number of state and federal agencies.
Those providing input include Phil Benedict, VT Ag, Food, and Markets; Dick Croft, Tony Esser, and Bob Kort, Natural Resources Conservation Service; and Eric Smeltzer, VT Dept of Env Conservation.
The Quebec values are shown for illustrative purposes only and are presented to reflect the cost of achieving the 1993 international agreement.

Holmes & Associates and Anthony Artuso 1996.

centration target. If the in-lake target for Missisquoi Bay is made even 5% more stringent than the 28.5 ug/l included in the above analyses, the present value of phosphorus control costs increase by more than $100 million. This is because in order to achieve in-lake phosphorus concentrations lower than 28.5 ug/l in Mississquoi Bay, relatively expensive urban BMP's must be implemented on a high percentage of urban land in that watershed. However, due to the lack of detailed land use and agricultural data for the Quebec portion of the Mississquoi Bay watershed, results of the model for this watershed should be interpreted only as general approximations. More detailed modeling of this watershed in cooperation with the Province of Quebec is needed before a cost-effective phosphorus control strategy can be reliably developed for Missisquoi Bay.

If New York State does not require implementation of any additional point source controls, the analysis outlined above indicates that the savings to New York, assuming there is continued implementation of cost-effective nonpoint source controls, amounts to only about $150,000 per year. However, a greater share of the costs of achieving the in-lake phosphorus objectives is shifted to Vermont. In addition, there is greater dependence on nonpoint source controls, which have greater variability in costs and effectiveness than point source controls. Therefore:

- **The most effective and cost-efficient approach to controlling phosphorus in the Lake Champlain basin is projected to have annual costs of $4.5 million in Vermont and $1.0 million in New York.** Four scenarios were modeled by the study team for controlling phosphorus in the Lake Champlain basin, with Scenario 3 (Targeted Point Source Controls) appearing to be both the most cost effective at controlling phosphorus.

1.3.1.1 Wastewater Treatment Facilities

In order to update the costs for upgrading the treatment plants to include additional sludge handling facilities and sludge disposal and to develop more accurate estimates of cost to upgrade the treatment plants for phosphorus removal on a treatment plant specific basis, the study team performed a more detailed cost evaluation of upgrading treatment plants within the basin. All costs are preliminary and assume chemical addition for phosphorus removal. Some of the treatment facilities within the basin already have chemical storage and addition facilities; however, since phosphorus limits are not in their permit, these chemical facilities are currently not being used. Treatment facilities such as Saranac Lake, Peru, Crown Point, and Willsboro, New York, which were recently upgraded or newly constructed include chemical addition facilities since the design was prepared in anticipation of phosphorus limits ultimately being imposed. Most treatment facilities within the basin, however, will require new chemical addition facilities. The method of sludge handling at each facility and the existing sludge handling facilities at each plant was taken into consideration when estimating the costs for treatment plant upgrades.

On the New York side of Lake Champlain, the following treatment plants were targeted to obtain more accurate cost estimates for upgrading the facilities:

Dannemora	Granville	Rouses Point
Keesville	Lake Placid	Whitehall
Peru	Plattsburgh City	Ticonderoga
Port Henry/Moriah	Saranac Lake	Champlain

F. X. Browne, Inc. met with New York DEC facilities engineers for the above plants to obtain as much information as possible regarding these plants. The following information was obtained for each of the plants:

1. Process descriptions of the plants, including the plant flow schematic
2. Current phosphorus effluent levels for each plant for the past two years
3. The current method of sludge handling and the sludge disposal
4. General operating conditions of the plants.

After reviewing New York DEC files and speaking with the facilities engineers, several treatment facilities were visited to obtain first hand information regarding the treatment plants. Detailed descriptions of select New York treatment plants are provided as an Appendix. Cost estimates for upgrading the treatment plants were then developed for each treatment plant. Cost estimates include equipment costs, contractor installation and markup costs, engineering design costs, and construction observation costs. Besides actual equipment costs, costs of buildings required to house new equipment and yard piping and repiping costs were also estimated. Equipment costs were obtained from vendors when possible. Operation and maintenance costs were also estimated. Costs for disposing of increased sludge volumes were based on average actual costs that municipalities in the basin are currently spending on sludge disposal. All costs were compared with recent costs from similar construction projects and were adjusted, as needed, for each treatment plant.

Only five Vermont treatment plants listed in the Diagnostic Feasibility Study required a more detailed cost estimate for upgrading. These plants include Brandon, Fair Haven, Richmond, Northfield, and West Rutland.

The State of Vermont has made a commitment to finance necessary municipal wastewater treatment plant up-grades at the state level. The financing for wastewater treatment facilities in New York was undetermined at the time of this research. In an economic review of local fiscal capacity in the New York portion of the basin, the picture that emerges is one of a region with income levels that are substantially below the state norm, with the resulting limitations on local government spending that these income levels imply. Consistent with this picture is the region's relatively high level of dependence on resources supplied from outside in the form of aid payments from other governments. Despite the region's ability to generate tax revenue from non-residents, its ability to tax residents is still limited by their relatively low incomes.

At the present time, the only significant non-local source of funds for construction or improvement of wastewater treatment facilities is the Revolving Loan Fund administered by New York's Environmental Facilities Corporation (EFC). This organization makes loans rather than grants, using combined federal and state funds to offer municipalities an interest rate subsidy that lowers the total interest paid on bonded debt by about 50 percent. Despite this interest rate subsidy, it is clear that the shift from grant programs to the Revolving Loan Fund has transferred a large share of treatment plant costs to local governments. Very limited possibilities exist for grant-type funding through federal Department of Housing and Urban Development and Rural Development Administration. The application constraints and competition for funds which characterize these programs render them inconsequential to plant upgrading of the quality and scale envisioned in the Lake Champlain Plan. A final source of funds in New York is what is termed the "member item," a state grant for a local project that the locality's elected representatives in Albany successfully place in the state budget. Although such grants are not uncommon, they probably can not be relied upon to fund a number of municipal projects in the same area of the state within any reasonable time period. However, in the case of a municipality such as Dannemora, which contains a large state prison facility that presumably produces a large share of the total effluent that passes through the treatment facility, a strong case can be made by the local government for a special state appropriation to help pay for the upgrading.

The funding situation for municipal wastewater treatment facilities is thus relatively bleak at the present time. Without state assistance, any current upgrading would fall heavily on localities, and it would be borne primarily by local residents and businesses. Even if local citizens placed a very high value on water quality, and believed the full cost of upgrading required under any of the policy scenarios justified, they might still consider delaying the improvements in the hope of receiving federal or state grants after institution of greater state and/or federal cost sharing at some time in the future.

1.3.1.2 Agriculture

The economic implications on agriculture were examined by the study team. To put the analysis in perspective it should be recognized that it will get increasingly difficult for dairy farms with less than 100 cows to remain economically viable in the Northeast unless they can continue to lower their costs. In order to stay in business the small dairy farmer will have to carefully assess the economic aspects of all phases of his operation. The economic analysis report focuses on only one of the many aspects of a modern dairy farming operation, manure management. The study team devoted project resources to an economic analysis of manure management because manure is a major source of phosphorus flowing into the lake in some areas of the basin. The analysis offers farmers and decision makers one of the most complete economic analyses of manure management available for any watershed area in the nation. One of the conclusions from the analysis is that smaller farmers may see a positive economic impact on their operation by contracting out their manure spreading.

Manure can be a valuable source of nutrients for cropland if managed correctly and if there is need for its nutrient value. However, if mismanaged, manure can be a source of phosphorus pollution in lakes and streams. To achieve a reduction in nonpoint pollution from agriculture in the basin will require some farms to change their manure management practices. Ecologically sound manure management practices include diversion of barnyard run off, safe storage, maintenance of grass cover between water ways and cultivated fields, and elimination of manure spreading on frozen ground. Each of these practices is designed to eliminate or reduce the amount of manure runoff into adjoining waterways. All these practices are currently being used in various locations around the basin.

The elimination of manure application on frozen ground is perceived by some farmers as a major change to their past farming practices. The elimination of daily spreading in the winter will require farmers to store their manure and apply it during periods where the potential for runoff is lower. The economics of moving away from daily spreading is a major topic of concern, especially for the small and medium sized dairy farmers. The costs to dairy farmers of alternative manure management practices to daily spreading are examined in the report. Vermont has banned the spreading of manure between December 15 and April 1 as part of the state's Agricultural Nonpoint Source Pollution Reduction Program.

In addition to cost estimates, the crop nutrient (fertilizer) value of manure in each alternative management practice is estimated. The nutrient values in conjunction with the cost estimates are used to project net benefits or costs of alternative manure management practices relative to daily spreading. The sensitivity of each alternative's annual cost and net benefit to changes in government cost sharing of capital expenditures associated with building a storage structure is also examined.

1.3.1.3 Urban Runoff

Another issue that can be evaluated with the aid of the model are the implications of developing strong phosphorus control requirements for new urban and suburban developments. It is almost always less expensive and less difficult politically to require phosphorus control measures in new urban/suburban development rather than retrofitting existing developments. If it is assumed that new urban/suburban developments are required to install structural control measures (e.g. detention ponds) that reduce phosphorus export rates by 50%, then projected nonpoint source loadings would decline by more than 11 metric tons relative to the no action scenario outlined above. The result of this requirement would be to reduce the phosphorus export from new urban developments to a level roughly equivalent to average agricultural export rates, thereby virtually eliminating any growth in nonpoint source phosphorus loadings due to land use change.

1.4 Comparison of Costs of the Recent Vermont and New York Phosphorus Control Agreement with Scenarios Outlined in the Economic Analysis Report

The report on the Economic Analysis of the Lake Champlain Pollution Control and Restoration draft Final Plan outlines four phosphorus reduction scenarios. The first scenario included the point source control standard that was previously referred to as policy option 2 in the Draft Plan. This standard would require a phosphorus discharge concentration of 0.8 mg/l for all facilities with permitted flow in excess of 0.2 million gallons per day (mgd). The first scenario outlined in the Economic Analysis report also included nonpoint source controls to achieve the in-lake phosphorus criteria in a cost-effective manner, given the 0.8 mg/l point source standard. The present value of the capital and operating cost of this phosphorus reduction strategy was estimated to be $176.1 million or approximately $11.5 million on an annualized basis.

The second phosphorus reduction strategy presented in the Economic Analysis report includes what was previously referred to as policy option 3 in the Draft Plan. This entails a concentration standard of 0.5 mg/l for all facilities with permitted flow in excess of 0.2 million gallons per day (mgd) and then seeks to target nonpoint source controls in a cost-effective manner to achieve the in-lake phosphorus criteria. The present value of the capital and operating cost of this phosphorus reduction strategy was estimated to be $176.7 million or approximately $11.5 million on an annualized basis. While the total costs of this phosphorus control strategy are almost identical to the first strategy described above, this second strategy relies more heavily on point source controls.

The third phosphorus reduction strategy provided for complete flexibility in targeting both point and nonpoint source controls to achieve the in-lake criteria most cost effectively. Under this least cost strategy, the estimated present value costs declined to $109.8 million per year which is equivalent to $7.1 million on an annualized basis. Only a few treatment facilities in New York were identified as requiring phosphorus control measures under this least cost scenario. These include Great Meadows Correctional Center, Port Henry, Peru, and Lake Placid.

The final phosphorus reduction strategy that was examined involved no point source controls in New York and targeted point source controls in Vermont together with cost effective targeting of NPS controls in both New York and Vermont. This scenario has an estimated present value cost of $115.1 million which equates to $7.5 million on an annualized basis. The constraint of having no point source control measures in New York increases the present value costs of this strategy by $5.3 million relative to the most cost effective strategy described above. It also shifts more of the costs to nonpoint sources and increases the share of the total costs borne by Vermont.

The phosphorus reduction strategy agreed to by the Governors of New York and Vermont and approved by the Lake Champlain Management Conference is roughly equivalent to the least cost strategy outlined above in that it allows full flexibility in the mixture of point and nonpoint source controls used to achieve the overall phosphorus loading targets. The Agreement departs somewhat from a true least cost strategy in that it sets phosphorus loading targets for each lake segment watershed in each state, rather than allowing each state full flexibility in achieving the in-lake phosphorus standards. In other words, it does not appear that the agreement would allow either state to offset lower phosphorus reductions in one watershed with greater phosphorus reductions in another, even if this would still achieve the in-lake phosphorus standards. However, this departure from a fully flexible least cost approach may be necessary in order to provide load reduction targets that are easy to understand and monitor. It is also possible that reallocations of phosphorus reductions between watersheds can be negotiated and agreed to on a periodic basis if studies indicate that these revised targets would be less costly and would still achieve water quality objectives.

The phosphorus reduction targets for each watershed that were outlined in the Agreement were based in part on new data on point source loads and estimates of phosphorus reduction due to prior agricultural nonpoint source controls. Apparently, several major treatment plant upgrades have recently been completed in Vermont and New York. As a result the Agreement is based on significantly lower point source phosphorus loadings than were used in the Economic Analysis report. In addition, nearly 30 metric tons of phosphorus loadings were estimated to have been removed as a result of nonpoint source controls implemented since 1987.

The revised estimates of current point and nonpoint source loads that were used to develop the Phosphorus Reduction Agreement were obtained from Eric Smeltzer at VTDEC and have been used by the Economic analysis study team to estimate the direct costs of the Agreement. The cost estimates outlined below incorporate this new data. However, the analysis summarized below also incorporates the projections of increased point and nonpoint source loadings due to population and land use changes that were developed for the Economic Analysis report. Consequently, while the total future loadings by watershed are equivalent to those outlined in the Agreement, the estimates of load reductions relative to a no action differ for some watersheds.

The present value of the capital and operating cost of achieving the phosphorus loading targets outlined in the Agreement is estimated to be approximately $83.5 million which is equivalent to $5.4 million on an annualized basis. This is lower than the least cost strategy presented in the Final Draft of the Economic Analysis report because, as described above, the agreement is based on a lower estimate of current point and nonpoint source phosphorus loadings and therefore requires a lower level of future reductions.

Given the revised point and nonpoint source loading estimates used in the Agreement, the 0.8 mg/l point source standard and targeted nonpoint source controls would cost approximately the same as the phosphorus reductions outlined in the Agreement. However, New York would pay a larger share of the costs under this option than under the Agreement.

The least cost strategy for achieving the in-lake phosphorus standards (with the exception of Mississquoi Bay and South Lake B) would be $76.1 million or $4.95 million on an annualized basis. The principal reason why the direct costs of the Agreement are estimated to exceed the least cost strategy is that given our projections of population and land use changes the Agreement would eventually require somewhat larger phosphorus reductions in a few watersheds than would be required under a least cost approach.

Using the updated estimates of current phosphorus loading, the costs of the Phosphorus Reduction Agreement as compared with the other phosphorus reduction scenarios are summarized in Figure 1-1.

The revised phosphorus reduction costs estimates do not significantly alter the basic results of the indirect cost and multiplier effects evaluation that is presented in the Economic Analysis report. The estimated annualized direct costs of the Agreement are $1.5 million lower than the least cost strategy originally outlined in the Economic Analysis report. However, this is largely due to the incorporation of data on recent point and nonpoint source control expenditures. The scenarios presented in the Economic Analysis report assumed that these expenditures would occur in the near future. Implementation of the Agreement would entail a distribution of costs between point and nonpoint sources and between each state that are very similar to those originally estimated in the Economic Analysis report. In addition, the in-lake phosphorus concentrations that would result from the Agreement are the same as or better than what was assumed in the tourism and recreational impacts analysis of the Economic Analysis report. In sum, the economic impacts that would result from implementation of the Agreement would not differ significantly from those outlined in the Economic Analysis report.

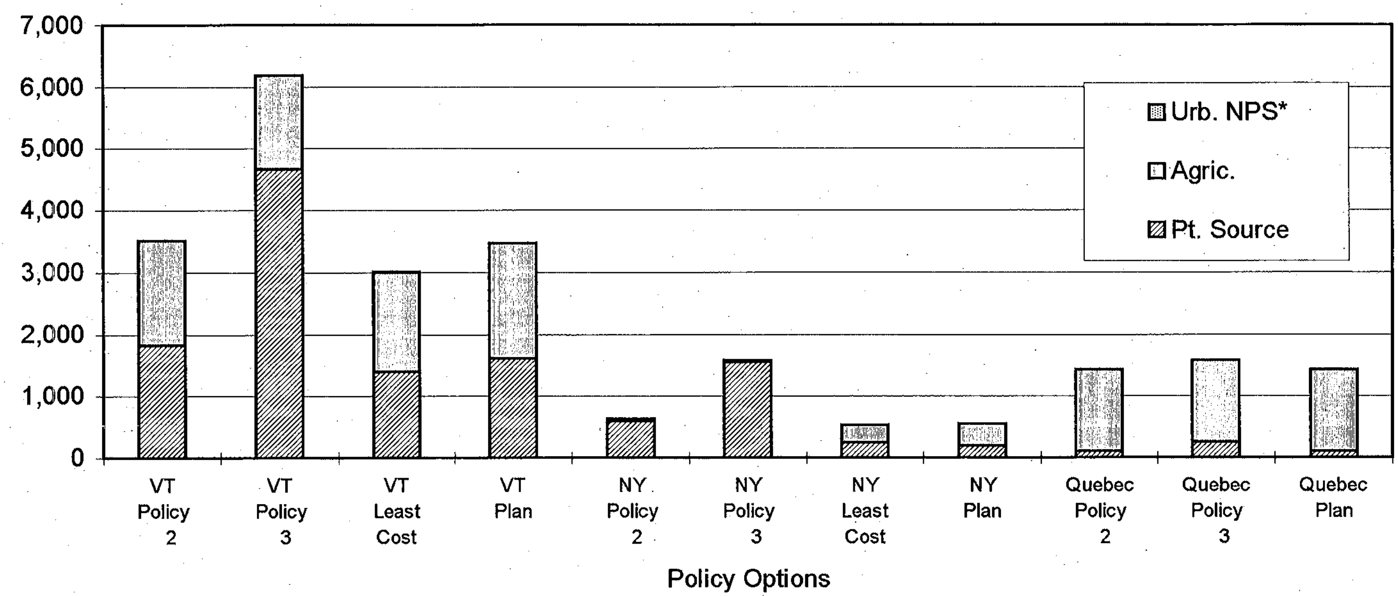
1.4.1 Non-Phosphorus Actions

There are seven non-phosphorus action categories in the Plan, including toxics, human health, fish & wildlife, wetlands, nuisance aquatics, recreation and cultural heritage. The economic implications of the high priority actions are discussed under the appropriate chapter headings in the economic analysis report and are highlighted later in this summary. The cost implications are summarized as follows:

- **In total, Vermont's annual expenditures on all the non-phosphorous actions would be $4.8 million during each of the first five years of implementation, and New York's expenditures would be $2.0 million.** Those figures are based on a 71% / 29% split of the estimated costs. The split is based on each state's share of total commerce in the Lake Champlain basin. Based on past federal funding practices, it is further projected that federal funding would provide for approximately 64% of those expenditures, reducing Vermont's share to $1.7 million and New York's to $.70 million.

Under a "No Action" scenario federal funds would not be available for the non-phosphorus activities, increasing the local costs for any actions that the state's may decided to pursue on their own.

Figure 1-1: Summary of Phosphorus Control Costs
(annually, in $000's of 1995 dollars)



* Urban non-point source control costs are negligible in this graphic.
VT Plan and NY Plan are based on details of the NY / VT phosphorus agreement as of July 1, 1996.
Province of Quebec data for illustrative purposes only, based on best available data at the time of this report.

Data analysis by Anthony Artuso, research for this project.
Holmes & Associates and Anthony Artuso 1996.

1.5 Modeling the Economic Impacts of Plan Implementation

To understand the economic impacts of both the cost of Plan implementation and the benefits of improved water quality on the Lake Champlain basin's economy, the direct economic effects must be traced through the economy. Direct economic effects may be defined as those changes in final demands that are immediately stimulated by a given event. For instance, the event of a large pre-Christmas snow storm has several direct economic effects on final demand in the tourist industry including increased ski lift ticket sales, hotel reservations and restaurant meals all of which can lead to the creation of new jobs and wages. These initial, or direct changes in final demand then lead to many more subsequent indirect changes in the demand for goods and services produced in the economy. The restaurants order more food products, consume more cooking gas, require increased linen service, etc. In turn, each of these impacts can also create new wages and jobs. These new wages and jobs provide more wealth to households, which induce them to consume more, subsequently creating more demand for goods and services. Thus, the total economic impact of an event is typically much larger than the size of its direct effects alone.

To measure how the direct effects of an event such as improved water quality reverberate through the economy, economists typically use Input-Output models that incorporate all of the direct, indirect and induced economic effects. This report used a computer generated input-output model of the Lake Champlain basin's economy based upon the IMPLAN model. The IMPLAN input-output model was originally designed by the US Forest Service and is currently maintained by the Minnesota IMPLAN Group, Inc. (MIG) in Stillwater, Minnesota.. IMPLAN is widely accepted as a useful tool for analyzing the economic impact of natural resource based events.

IMPLAN is grounded in the interindustry relationships between 528 different national production industries. In addition to the interindustry relationships that embody the production structure of the economy, IMPLAN incorporates an extensive county-specific database on government expenditures, inventory purchases, gross private capital formation, Commodity Credit Corporation inventories, federal government sales, employment and earnings, population, exports and imports.

The current model is constructed on the basis of 1992 production relationships. The program includes industry-specific deflators that translate current expenditures to this 1992 base year, and all dollar reports are in 1992 dollars. The model also includes industry specific "regional purchase coefficients" (RPCs) which, derived through multivariate regression techniques, estimate the proportion of increased demand for an industry's products that will be supplied from local producers.

The study team has tailored the IMPLAN modeling to treat state and local government expenditures as costs by computing the economic impact those funds would have had if they were spent by consumers. The reasoning is that expenditures financed by regional tax sources represent a redistribution from households (tax payers) to state and local government. Subsequently they imply a redistribution in the region's consumption patterns. For purposes of modeling the subsequent increase in regional government spending and taxes, households' personal consumption expenditures (PCE) were reduced by an equivalent amount. Implicit in this approach is that no existing government expenditures would be replaced by these new initiatives.

1.5.1 Economic Benefit and Cost Projections

The projected economic impacts of Plan implementation presented in this report are based on all of the non-phosphorus action items being implemented and one of the phosphorus control scenarios. Table 1-3 provides a summary of the economic impacts in Vermont of each of the four scenarios. That considerable modeling effort was carried out by Economic & Policy Resources, Inc. of South Burlington, Vermont and includes all scenarios and all time periods (i.e., Phases). The presentation is for comparative purposes only since the LCMC is not recommending that either Scenario 1 or 2 be implemented. The New York IMPLAN modeling was done only on Scenario 3.

The most significant result from the preliminary IMPLAN analyses, as shown in Table 1-3 and Table 1-4, is that all four proposed scenarios would lead to increased employment over both the short and long term (Phase 1 and 2). Phase 1 economic activity represents the construction of phosphorus control facilities (e.g., waste water treatment plant improvements, manure confinement), operation and maintenance (O&M) costs beginning in Year 2, and initiating implementation of the non-phosphorus programs. Phase 1 accounts for Years 1 - 5 of Plan implementation. The Phase 1 economic impacts are very stimulate to the basin economy because of the construction involved, but short-lived as they subside once the recommended capital improvements are put into place.

Phase 2 economic activity describes the long-term economic impacts in two sub-phases. Phase 2A represents the O&M economic activity related to phosphorus control and continued implementation of the non-phosphorus programs. The duration of Phase 2A is roughly Years 6 - 30. Phase 2B represents the economic value to the basin of improved water quality in Lake Champlain. The economic impact is modeled as a potential increase of 1%, 5%, or 10% in tourism expenditures over present levels. Those possible increases in recreation use related to water quality improvement are expected to begin occurring in Year 11 and continue indefinitely. The assumption in Phase 2B is that a cleaner lake will yield some level of economic benefit in the basin. While the economic impact is assumed to be positive, at this time the exact level of recreational response to an incremental improvement in water quality is unknown. The range of 1% to 10% is assumed to bracket the likely increases in recreational activity resulting from Plan implementation.

The preliminary economic assessments for Scenario 3 demonstrates that environmental planning approaches which employ least cost methods may offer the greatest economic benefits and the smallest economic costs as measured by employment and value added. Additional major findings from the IMPLAN modeling are listed below.

- **As computed by the IMPLAN model, recreational activity in the vicinity of Lake Champlain resulted in 5,654 jobs in 1992, with a total value added in Vermont and New York of $154 million.** The resulting total economic impact in Vermont -- direct, indirect and induced impacts -- of the $77 million in Lake Champlain dependent expenditures was estimated at 3,707 jobs and $97 million dollars in value added for the basin's economy. The $97 million in value added represents $77 million in expenditures and $20 million in induced and indirect economic effects as computed by the IMPLAN model. In the New York portion of the basin, the impact of Lake Champlain recreation was estimated at 1,947 jobs and $57 million in value added.

Table 1-3: Vermont Summary of Lake Champlain Plan Economic Impacts as Determined by the IMPLAN Analysis (Annually, in Millions of 1992 Dollars)

Phosphorus Scenario	Type of Economic Impact	PHASE 1: Implementation and Construction[1]					PHASE 2A[2]	PHASE 2B Years 11 - 30 (percentage tourism increase)		
		Year 1	Year 2	Year 3	Year 4	Year 5	Years 6 - 10	+ 10%	+ 5%	+ 1%
Scenario 1 (.8 mg/l)	Employment [persons][4]	233	227	220	214	208	114	428	242	94
	Employee Compensation[5]	6.2	6.1	6.0	6.0	5.9	4.4	8.0	5.2	3.0
	Total Value Added[6]	8.0	7.8	7.7	7.6	7.4	4.6	12.2	7.3	3.4
Scenario 2 (.5 mg/l)	Employment [persons][4]	207	200	193	186	179	113	425	239	91
	Employee Compensation[5]	5.8	5.7	5.6	5.5	5.4	4.4	7.9	5.2	3.0
	Total Value Added[6]	7.1	7.0	6.8	6.7	6.6	4.7	12.1	7.3	3.4
Scenario 3 (targeted point source controls)	Employment [persons][4]	231	227	223	220	216	127	441	255	107
	Employee Compensation[5]	6.2	6.1	6.1	6.0	6.0	4.5	8.1	5.4	3.2
	Total Value Added[6]	7.9	7.8	7.8	7.7	7.6	4.9	12.4	7.6	3.7
Scenario 4 (no New York point source controls)	Employment [persons][4]	241	236	232	228	224	124	438	253	104
	Employee Compensation[5]	6.3	6.3	6.2	6.2	6.1	4.5	8.1	5.3	3.1
	Total Value Added[6]	8.2	8.1	8.0	8.0	7.8	4.8	12.4	7.5	3.7

1. Phase 1 is the phosphorus control construction during years 1 -5. O & M costs are assumed to begin in year 2. Non-phosphorus programs begin in Year 1.
2. Phase 2A represents years 6 to 10 when the non-phosphorus programs continue, as do O & M costs. Year 6 represents annual O & M costs for the life of the project.
3. Phase 2B is the water quality improvement stage beginning approximately 11 years after implementation, projected as a possible 10%, 5%, or 1% increase in tourism expenditures over current levels. The tourism impacts differ between scenarios because of differences in O & M costs in years 11 - 30.
4. Employment is the net change in number of jobs in the Vermont portion of the basin. The employment increase accounts for reduced employment that would result from lower consumer spending to pay for the Plan.
5. Employee compensation is total wages paid to employees working within the Vermont portion of the basin.
6. Total Value Added is the net economic impact in the Vermont portion of the basin from federal , state, local, and private expenditures related to the Plan. It included employee compensation as well as other types of income and tax revenues.

The economic analysis is preliminary because the benefits do not account for property value increases, potential non-use benefits (e.g., option, existence, bequest values), and other benefits related to improved water quality in Lake Champlain. In addition, the analysis assumes a certain level of federal funding.
Source: Economic and Policy Resources, Inc. and IMPLAN (research for this project).
Holmes & Associates and Anthony Artuso 1996.

Table 1-4: New York Summary of Lake Champlain Plan Economic Impacts as Determined by the IMPLAN Analysis of Scenario 3 (Annually, in Millions of 1992 dollars)

Phosphorus Scenario	Type of Economic Impact	PHASE 1: Implementation and Construction[1]					PHASE 2A[2]	PHASE 2B Years 11 - 30 (percentage tourism increase)		
		Year 1	Year 2	Year 3	Year 4	Year 5	Years 6-10	+ 10%	+ 5%	+ 1%
Scenario 3 (targeted point source controls)	Employment [persons][4]	48	49	56	59	53	35	223	141	74
	Employee Compensation[5]	1.6	1.7	1.9	2.0	1.8	1.2	4.4	3.1	2.1
	Total Value Added[6]	1.9	1.9	2.1	2.2	2.1	1.4	7.0	4.6	2.7

The economic analysis is preliminary because the benefits do not account for property value increases, potential non-use benefits (e.g., option, existence, bequest values), and other benefits related to improved water quality in Lake Champlain. In addition, the analysis assumes a certain level of federal funding.

1. Phase 1 is the phosphorus control construction during years 1 -5. O & M costs are assumed to begin in year 2. Non-phosphorus programs begin in Year 1.
2. Phase 2A represents years 6 to 10 when the non-phosphorus programs continue, as do O & M costs. Year 6 represents annual O & M costs for the life of the project.
3. Phase 2B is the water quality improvement stage beginning approximately 11 years after implementation, projected as a possible 10%, 5%, or 1% increase in tourism expenditures over current levels. The tourism impacts differ between scenarios because of differences in O & M costs in years 11 - 30.
4. Employment is the net change in number of jobs in the New York portion of the basin. The employment increase accounts for reduced employment that would result from lower consumer spending to pay for the Plan.
5. Employee compensation is total wages paid to employees working within the New York portion of the basin.
6. Total Value Added is the net economic impact in the New York portion of the basin from federal , state, local, and private expenditures related to the Plan. It included employee compensation as well as other types of income and tax revenues.

Source: Economic and Policy Resources, Inc. and IMPLAN (research for this project).
Holmes & Associates and Anthony Artuso 1996.

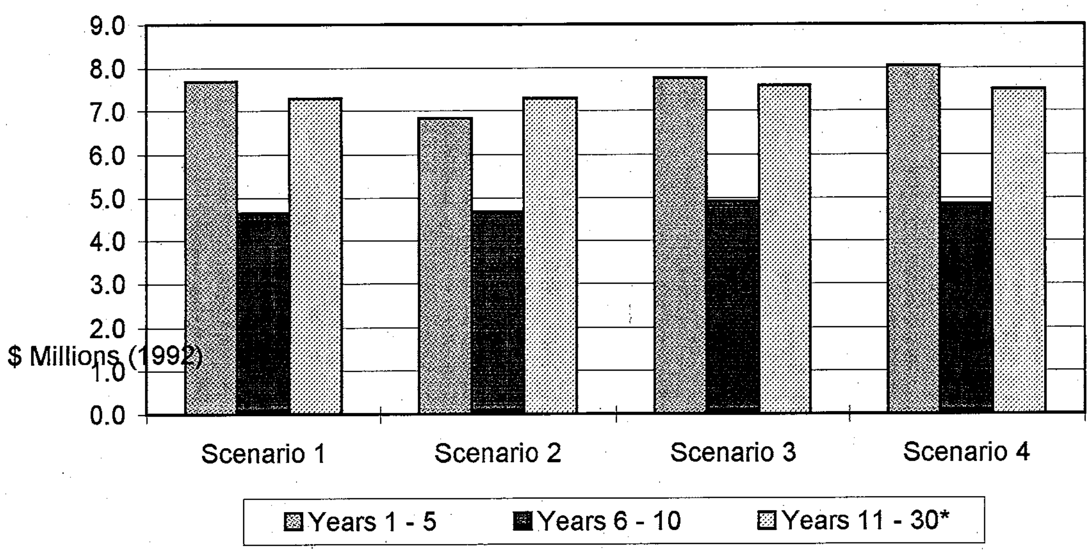
- **Preliminary results using IMPLAN indicate that in Vermont Scenario 3 could produce an additional 127 new jobs beginning in Year 6, and $4.9 million in value added annually.** In New York, there would be 35 new jobs beginning in Year 6. Value added in the New York basin economy would total $2.1 million annually, of which $1.8 million would be employee compensation. In addition, possible increased recreation activity related to water quality improvement could result in 91 to 425 new jobs in Vermont, and $3.4 to $12.1 million in value added. The lower number is attributable to a 1% increase in recreational activity around the lake, while the higher number is tied to a 10% increase in recreational activity attributable to the Lake Champlain restoration and protection effort. The middle-range estimate, based on a 5% increase in recreational activity over present levels, yields an annual economic impact in Vermont of approximately 255 jobs and $7.6 million in value added. The positive economic impacts in New York would include 74 to 223 new jobs and $2.7 to $7.0 million in value added annually..
- **In addition to the long term impacts, short term economic impacts could produce approximately 230 jobs and $7.6 million in value added in Vermont during each of the first five years of Plan implementation.** In New York the short term impact would be approximately 50 jobs and $2 million in value added annually during the first five years of implementation. These impacts result from construction and engineering expenditures related to phosphorus control, and from employment and research related to the non-phosphorus plan items. The construction phase is projected to end in year 5. In subsequent years a portion of the positive economic impact is partially off-set by operation and maintenance costs for the improvements at waste water treatment facilities.

Scenario 3 results in 231 new jobs in Vermont in Year 1, declining annually to 216 jobs in Year 5. The Plan recommendations result in 127 jobs annually in Years 6 - 30. The net benefit in the basin is a $7.9 million in Year 1, approximately $7.7 million in Years 2 - 5, and $4.9 million in Years 6 - 10. In Phase 2B, beginning in Year 11, a 1% increase in tourism activity resulting from Plan implementation yields a net annual benefit of $3.7 million. A 5% increase in tourism activity results in a $7.6 million positive flow annually in Vermont, beginning in Year 11. Of the four scenarios analyzed in this research, Scenario 3 appears to the most cost effective in Vermont and results in a positive flow of capital into the basin throughout the projected period of implementation. Figure 1-2 further illustrates the cost effectiveness of Scenario 3. The recent (June, 1996) phosphorus control agreement between Vermont and New York involves a similar approach to targeted point source control as represented by Scenario 3.

In New York, Scenario 3 results in 48 new high pay construction and engineering jobs in Year 1, increasing to 53 jobs in Year 5. The Plan recommendations result in 35 new jobs annually in Years 6 - 10. The net benefit in the basin is a $1.9 million in Year 1, approximately $2.1 million in Years 2 - 5, and $1.4 million in Years 6 - 10. In Phase 2B, beginning in Year 11, a 1% increase in tourism activity resulting from Plan implementation yields a net annual benefit of $2.7 million. A 5% increase in tourism activity results in a $4.6 million positive flow annually in New York, beginning in Year 11. Given the comparative findings of the four scenarios in Vermont, Scenario 3 appears to the most cost effective approach in New York and it results in a positive flow of capital into the basin throughout the projected period of implementation.

It is important to recognize the scope of the data and IMPLAN when interpreting these preliminary results. The actual long term employment outcomes will depend on the level of water quality improvement and the subsequent reaction in the tourism industry. The smaller the resulting increase in tourism, the smaller the increase in employment and other economic benefits. A significant amount of federal funding is also included in these preliminary projections. Without this funding, the projected employment outcomes would be smaller. All federal funds have been treated entirely as money derived from outside sources. Of special significance is the impact of O & M expenditures in the phosphorous reduction strategies. The preliminary IMPLAN results indicate that O & M expenses have a negative net impact on job creation. Thus, if future tourism increases are not realized and / or federal funding does not occur, the economic benefits of these proposed initiatives will be reduced significantly.

Figure 1-2: Vermont Summary of Total Value Added Related to Implementation of the Lake Champlain Plan, by Scenario and Phase



* Assumes a 5% increase in tourism activity beginning in Year 11. Tourism activity increases of 1% or 10% would affect the level of value added in Years 11-30, but not change the comparative relationship of the four scenarios.

Source: Economic and Policy Resources, Inc. and IMPLAN (research for this project).
Holmes & Associates and Anthony Artuso 1996.

The preliminary results indicate that the "Opportunities for Action" recommendations for improving water quality would have positive net economic impacts. These impacts are not large in terms of the entire basin economy but may be sizable if concentrated in a few local economies. Of equal importance is consideration of the types of jobs that would be created. The largest projected employment gains occur in service sector occupations and include both full and part-time positions. These include retail stores, eating and drinking places, and hotels and lodging places. These sectors are typically low paying. Additionally, this preliminary analysis does not consider potential special economic impacts that improved water quality may have. For instance, improved water quality in Lake Champlain would increase the basin's quality of life, a factor shown to influence the location decisions of high-tech manufacturers. Other factors such as improved public health and reduced drinking water treatment costs also have not been considered. Such factors should be included in any comprehensive assessment of the costs and benefits of these proposed water quality initiatives.

1.6 Understanding the Perceived Economic Implications of Plan Implementation

The prior discussion focused almost exclusively on quantifying the costs and benefits related to Plan implementation, however, economic analysis involves more than quantifying monetary transactions. Additional issues that the study team has attempted to address include the following:

- What are major economic issues and trends in the basin that relate to Lake Champlain?
- Are there other, indirect benefits and costs of improving Lake Champlain?
- How will the economic benefits actually materialize in the local economy?, and,
- Where in the basin will the costs and benefits occur?

In order to gain a better understanding of how particular types of business perceive the Plan affecting their day-to-day operations, the study team convened two economic focus groups during our preliminary economic analysis work and a third economic focus group session during this project. In addition, the study team sent out a survey to recreation businesses around the lake and to local governments in the basin, asking for their perceptions of Plan-related economic issues.

1.6.1 Economic Focus Group Sessions

The economic focus group sessions were morning sessions held at three different locations on the lake shore. The original list of invitees to the focus group session totaled 156 people residing and working around the basin. Twenty individuals attended the first session, nine participated in the second, and five participated in the third. A total of 26 different individuals representing economic interests around the basin became involved in these formal discussions on the economic issues involved in the Lake Champlain planning effort. Those in attendance represented a very wide cross-section of economic interests around the lake, including: marinas, the paper industry, City of Burlington, Plattsburgh Chamber of Commerce, local government, agriculture, forestry, recreation, banking, the charter boat sports fishing industry, and watershed associations. The meetings were facilitated by a professional facilitator who was assisted by the study team and Lake Champlain Basin Program staff.

The following two paragraphs summarize the type of discussion and disagreements that occurred during the first session:

> Some participants felt that the economic benefits have to be area specific and should not reflect the value of the lake to the greater basin population, many of whom may not receive any direct economic benefit from the lake; while others felt that since this is a Plan for the future, a wide variety of possible present and future benefits should be considered. One aspect of the basin-wide benefits of a clean lake was expressed in terms of the lake as an asset to local industry in attracting higher caliber employees.
>
> Some felt that primary, secondary, and tertiary costs should be quantified for specific areas around the lake and that the estimated benefits should only be accounted for in relation to those specific ar-

eas. Others pointed out that recreational benefits of cleaner water could occur throughout the lake, so it will be difficult to reconcile costs and benefits for a particular bay or other location on the lake.

During the second session, the main discussion centered on specific measures to boost economy and business while protecting Lake Champlain, and at least 11 distinct proposals were offered and discussed. Most seemed to be heartily supported by the group present, although there was no attempt at a group consensus. Some of the main themes running through the ideas include the following:

- Innovation, ideas, creativity -- all need to be encouraged in the private sector and supported by government.
- Pollution prevention is key to cleaning up the lake, and prevention is tied to the encouragement of innovation, as noted in 1 above.
- There is a role for government in protecting local economies while preventing pollution of Lake Champlain.
- On-going Lake Champlain planning efforts must facilitate and accommodate the participation of economic interests.

The third session focused on reviewing a draft version of the Economic Analysis report, and was held on April 11, 1996. The study team was able to incorporate the edits and suggestions into the final draft of the report.

1.6.2 Questionnaire Surveys

The recreation site survey carried out for this research asked recreation providers to evaluate possible factors affecting recreation activity near their facilities. Respondents were asked to rate on a scale of +3 to -3 how much of an influence each of the items were on encouraging or discouraging visits to their area of the lake. The +3 indicated a very positive influence on visitation, while the -3 indicated a very negative influence.

The most negative item, discouraging visits to the area was seen as the Canadian exchange rate, a factor that few of us have any control over. Also recognized as negative factors, although near the neutral category, were some of the Lake Champlain environmental factors, namely aquatic weed growth, fish consumption advisories, and zebra mussels. There appears to be the perception among the recreation providers that these issues are affecting tourism around Lake Champlain, but not to a great degree.

The local government survey listed 12 community and environmental programs that roughly parallel the major recommendations in the Lake Champlain Plan. The survey respondents were asked how their community might set funding priorities should federal or state funds become available for the given program, and then to select the highest and second highest priority from their perspective.

The highest priority item for the 17 local governments responding to this section of the survey was *Safe Drinking Water Act compliance*, selected by 9 respondents, or 53% of the governments. The next highest priority was *testing of private septic systems in shoreline areas*, selected by 3 respondents. When asked about the 2nd highest priority, 4 local governments selected *developing management programs for nuisance aquatics* such as zebra mussels, lamprey eel, water chestnut, etc. Another 4 selected a*dvertising and promoting the region's recreational and cultural attractions*. Two each selected *toxic pollution control programs* and *wastewater treatment plant improvements to control phosphorus*.

It seems evident that local governments recognize benefits in many of the Lake Champlain priority items. In fact every item listed was mentioned by at least one of the 17 local governments as a priority item. As a group, local governments are most supportive of funding that will aid in Safe Drinking Water Act compliance. It is interesting to note that it is not simply the need for financial assistance that is driving their support for this recommendation. The comments illuminate their interest in protecting drinking water resources because their local tourism economies depend on the perception of a safe, healthy environment, and because drinking water "affects all life".

In summary of the community outreach aspect of the study team's work, the following benefits and costs are identified as important to local economic interests around the basin:

Benefits

The value of a cleaner lake to future generations.

The value of a cleaner lake to residents who rarely or never use the lake.

The influence of a cleaner lake in attracting high tech and other industries to the basin.

The impact of reduced fish consumption advisories on fishing and other tourism activity.

The impact of improved sewage treatment facilities on a small community's ability to attract and accommodate new industry and development.

The influence of a cleaner lake on property values and the resulting benefit to local taxing authorities.

The value of wetlands in the basin for flood storage, water quality, and erosion control.

The biological value and resulting economic value of wetlands for fish and wildlife habitat and ecological diversity.

Costs

The influence of nutrient management costs on farmers' ability to compete in national markets.

The influence of local tax increases related to wastewater treatment plant improvements on a small community's ability to attract new industries and development.

Costs to local industries related to the control or removal of toxic waste sites.

Possible influences on the quality of jobs in the basin, gaining low paying jobs while losing high paying jobs.

1.7 Overview of the Economic Implications of High Priority Actions

The following sections summarize some of the quantified and as yet unquantified economic implications related to Plan implementation. The discussion centers on the high priority actions as identified by the Lake Champlain Management Conference. The draft Final Plan "Opportunities for Action" provides descriptions of all the priority actions recommended by the Lake Champlain Management Conference.

1.7.1 Water Quality and the Health of the Lake

1.7.1.1 Reducing Phosphorus Pollution

As discussed above, the most cost-effective approach to controlling phosphorus in the Lake Champlain basin is projected to have annual costs of $4.5 million in Vermont, $1.0 million in New York, and $1.7 million in Quebec. Four scenarios were modeled by the study team for controlling phosphorus in the Lake Champlain basin, with Scenario 3 (Targeted Point Source Controls) appearing to be the most cost effective at controlling phosphorus.

The State of Vermont has made a commitment to finance necessary municipal wastewater treatment plant up-grades at the state level. The financing for wastewater treatment facilities in New York was undetermined at the time of this research. In an economic review of local fiscal capacity in the New York portion of the basin, the picture that emerges is of a region with income levels that are substantially below the state norm, with the resulting limitations on local government spending that these income levels imply. Consistent with this picture is the region's relatively high level of dependence on resources supplied from outside in the form of aid payments from other governments. Despite the region's ability to generate tax revenue from non-residents, its ability to tax residents is still limited by their relatively low incomes.

The direct benefits of water quality improvement by reducing the flow of phosphorus into Lake Champlain, or alternately the costs of water quality degradation that could result from no action, are quite diverse. They include recreational and/or health benefits for anglers, swimmers and boaters; aesthetic benefits for both local residents and visitors; and the bequest and existence values that residents within the basin and elsewhere might place on a cleaner lake.

These benefits are quite difficult to quantify even based upon studies designed for and conducted within the Lake Champlain basin. This research provided an overview of benefit estimates developed for other lakes located in northern climates, either in the northeast or upper midwest. Transferring per household or per user values from studies in other regions to Lake Champlain can only provide an preliminary indication of the potential range of potential benefits of water quality improvements.

The transfer of benefit estimates from other regions is further complicated by differences in water quality among segments of Lake Champlain. Benefits from improvement, or costs of degradation, of one lake segment may be tempered by the availability of relatively clean recreational sites at other parts of the lake. Without detailed studies of the factors which influence recreational use patterns around the lake it is not possible to determine the effects of water quality improvement or degradation in individual parts of the lake. If water quality changes were to occur throughout the lake, the per user net benefits of water quality improvements, or costs of water quality degradation, would be expected to be greater than for more localized changes. In this regard, it is important to note that in the no action scenario described in this report, the Main Lake and eight other of the thirteen lake segments would exceed their in-lake phosphorus standards.

The average of the more conservative estimates of net benefits of water quality improvement developed for 44 sites by Smith and Desvouges is approximately $11 per user per trip in 1995 dollars. The recreation site analysis of this report estimates that there are approximately 5.7 million user trips per season to beaches, marinas, boat launches, parks, and fishing sites on the lake. Multiplying a benefit of $11 per trip by 5.7 million trips yields a total direct benefits estimate of $63 million per year.

Using Needleman's and Kealy's estimate of $4.75 per capita for reduction in eutrophication and bacteria in New Hampshire lakes, yields a total benefit of $27 million when multiplied by the population of the lake Champlain basin.

Several of the other studies described in the report provide estimates of the benefits of water quality benefits in terms of per user per year. To indicate what these benefit estimates would imply if applied to lake Champlain it is necessary to determine the number of recreational users of the Lake. While total trips to beaches, marinas, boat launches and fishing sites on the lake were estimated to be approximately per year, many of these trips are made by repeat users. Some users that live quite close to the lake may make use of its recreational opportunities quite frequently. For others recreational use of the lake would be more sporadic. For purposes of analysis, we have assumed that the average user takes advantage of public recreational sites 10 times per season. This would imply approximately 570,000 individuals make use of Lake Champlain recreational facilities per year. Given this assumption, Parsons and Kealy's estimate of $23 per user per year for improving water quality in Wisconsin lakes would translate into a total benefit of $13 million per year for Lake Champlain.

In summary, the benefit estimates from these studies when applied to the relevant number of trips, users or population of the basin would indicate benefits of water quality improvement ranging from $13 million to an upper bound of $63 million per year.

In addition to these benefits to general recreational users of the lake, water quality improvement or avoidance of water quality degradation would provide benefits to lakeshore property owners. The study by Feather et al. found significant property value impacts due to water quality changes up to a mile from the lakes included in that study. The several hedonic valuation studies reviewed for this research indicated property value impacts in the range of 10% due to changes in water quality similar to those that might result in Lake Champlain from implementation of the Plan. The total assessed value of real estate in Vermont lakeshore towns in 1991 was approximately $7.2 billion and for New York shoreland towns the value assessed value of real estate was $1.6 billion for a total assessed value of $8.6 billion (Holmes & Associates 1993). If 5% of this assessed value of real estate in lakeshore towns is attributable to lakefront property, then a 10% change in value due to water quality changes would equate to an economic impact of $43 million. Since real estate prices capitalize the use value of a property over time this benefit (or avoided cost) of water quality improvement would be one time rather than an annual benefit.

1.7.1.1.1 Agriculture

The primary conclusion to be drawn from the economic analysis of agricultural manure management practices is that the need for government cost sharing declines with increases in farm size. Moving from daily spreading to an alternative manure storage option will be a costly proposition for the 60 cow farms with stall barns. The 60 cow farm with free stall barn has a cost efficient alternative in the gravity fill earthen pit with custom spreading. The costs are not nearly so severe for the 120 cow operation. With the exception of the above ground storage option, shifting from daily spreading to alternative manure management is economically attractive on the 240 cow dairy farms, given the increased nutrient value of manure.

The second conclusion to be drawn is that the construction of above ground manure storage tanks should be avoided whenever feasible. The cost of this storage practice, assuming no cost sharing, is more than twice as expensive as alternative storage practices on the 60 cow farm, and 66% more expensive on the large farms.

Beyond the benefits and costs of the various manure management options are broader concerns as to ability of the basin's farmland to absorb all the manure produced in the basin. As the trend towards larger farms continues, a related issue is the transporting of manure further and further from its source as required nutrient values are exceeded on farmland closest to the dairy barns. Custom hauling and composting are two agricultural activities that can address those issues and their use in the basin appears to be on the increase.

Custom hauling was integrated into the economic analysis and found to be very cost effective for some smaller farms. Composting of manure at central processing locations is potentially cost effective for some farmers, although it has not been studied in-depth in the basin. A marketing study for compost products in Franklin County, Vermont was carried out in 1995 and found that there is sales potential for locally produced compost.

The control of phosphorus on the farm is just one aspect of a farmer's overall environmental and economic planning. This research has shown that common and traditional practices (e.g., daily spreading) are not always the most cost efficient, while environmental research has shown that animal waste is a significant contributor of the pollution related to agriculture. However, a farmer, like any business person, often can not afford to purchase the latest technology to address a given problem. Facing tight profit margins, farmers are cautious about making major investments in equipment and facilities to control manure. The new farm management approaches being pursued by government and private interests provide the type of assistance farmers need in making difficult decisions. Whole Farm Management, Environmental Agricultural Planning, and Ecosystem-Based Assistance represent these new types of programs that attempt to integrate ecosystem, agricultural, and economic issues into farm management that is both environmentally effective and economically sound.

1.7.1.2 Preventing Pollution from Toxic Substances

Total annual expenditures for the three high priority items on toxic substances are estimated at $925,000. The three priorities are as follows:

Action 1. Focus on Toxic Substances of Concern and Sites of Concern, but Reduce other Toxic Substances Throughout the basin (a Highest Priority action)

Action 2. Develop and Implement Pollution Prevention and Control Strategies for Groups 1 and 2 Toxic Substances of Concern (a Highest Priority action)

Action 3. Accelerate Implementation of Pollution Prevention Programs in Targeted Watersheds

It is estimated that approximately 71% of that amount will be spent in the Vermont portion of the watershed, and 29% in the New York portion. Of the $656,750 spent in Vermont, an estimated 80% could be provided by federal funds, or $525,400. The remaining $131,350 is estimated as state, local, and private costs. Similarly, of the $268,250 in estimated costs to be spent on New York activities, approximately $214,600 would be a federal expenditure and $53,650 would be non-federal.

There is no information available to the study team that the recommended actions on toxics will have an adverse economic impact on the permitted industries and other discharging facilities in the basin. Current discharge permitting programs in Vermont and New York will continue as they have in the past. All of the major and most of the minor dischargers in the basin have been evaluated by the respective NY and VT Departments of Environmental Conservation (DEC) and appropriate water quality-based permit limits set. The proposed pollution prevention activities and incentive programs could result in a net gain to private industries in the basin, as discussed by business and government leaders in the Economic Focus Group Session 2. At the time of this report, IBM had announced plans to locate a new computer chip manufacturing facility in the Vermont portion of the Lake Champlain basin, indicating that the current regulation of toxics is not a deterrent to industrial growth in the basin.

To undertake an aggressive toxic pollution control program at the present time could involve significant costs and possibly yield very little in the way of immediate public health or ecosystem benefits. Conversely, a strategy of no action would modestly reduce short term costs but at the risk of delaying future benefits and/or failing to prevent future costs related to continued toxic contamination. A middle road of continued research together with prompt action on low cost prevention measures as recommended in the Plan seems most appropriate.

The most well publicized indicator of toxic pollution in the Lake Champlain ecosystem is the presence of high levels of mercury and PCBs in certain species of lake fish. One of the economic costs of toxic pollution are the detrimental human health effects that can occur from excessive consumption of contaminated fish species. But even if the consumption advisories were completely effective in preventing public health risks this would not eliminate other indirect costs imposed by toxic contamination of lake fish species. Toxic contamination of fish can reduce the number of fishing trips anglers make to Lake Champlain and reduce the net benefits they receive from each trip. There may also be secondary effects on other recreational activities and expenditures due to public perceptions about toxic contamination.

Research on fate and effects of PCB's and mercury should be given high priority since these substances are both widespread and already impairing fishing and other recreational uses of the Lake. The priority emphasis on pollution prevention programs is also well placed because it corresponds with the recent trends of industry recognizing that cost savings often result from pollution prevention programs. While there may be short-term costs related to the purchase of equipment or a change in the industrial process, pollution prevention can reduce the cost of disposal and often serves to keep the industry a step ahead of environmental regulations. As one industry representative pointed out at Lake Champlain Economic Focus Group Session #2, it is less expensive to prevent pollution at the source than it is to remove it at or beyond the end of the pipe. Pollution prevention is especially cost effective for the large national and international industries represented in the Lake Champlain basin (e.g., International Paper, Georgia Pacific, IBM) that can quickly and efficiently transfer successful pollution control techniques from one plant location to another. As discussed in the Economic Focus Group Session, private initiatives in pollution prevention should be encouraged and supported with awards and public recognition.

Increased recreational expenditures by anglers could result from these actions if the fish consumption advisories are removed or moderated. Total Lake Champlain angler expenditures are estimated at $32 million. A 1% increase in angler expenditures translates into an increase of $300,000 in recreational expenditures, while a 10% increase would be equivalent to a $3 million increase. To what degree this would increase overall economic activity in the basin would depend on what portion of any increase in angler expenditures would simply represent a shift from other types of local expenditures.

Annual increase in angler expenditures would depend on the success of the action. It would likely be limited or negligible during the first few years of the program, then increase provided a number of research and public outreach activities occur concurrently. For example, there is currently some confusion over which species can be eaten, when caught from which part of the lake, and which populations are at risk. Vermont and New York define the risks somewhat differently, adding to the confusion. The participants in the third Economic Focus Group Session discussed the idea of a public information pamphlet informing anglers and others on what is currently known about toxics in Lake Champlain fish. As one sport fishing charter boat captain related, he currently relies on newspaper articles and his own best guess when answering his clients' questions about toxic contamination. A standard pamphlet, updated regularly would be a major step in alleviating confusion and should contribute to improving the sport fishing industry on the lake.

According to representatives of the Lake Champlain Charter Boat Association, the sport fishing industry on Lake Champlain is starting to rebound, most likely in response to the successes of the sea lamprey control program. Many of the fishing charter services are experiencing a 10 percent increase in business over the past few years. The recommended actions on toxics could support or improve on that recent trend.

As with direct use benefits, the non-use benefits relate primarily to the removal of fish consumption advisories and the related perception that the lake is cleaner and safer. The perception of a clean environment has value in terms of people deciding where to take a vacation and where to reside. In addition, research has shown that property values respond to perceptions of water quality and pollution. These types of benefits would be limited in the case of Lake Champlain since both the sites of concern and the perceived threats to human health (i.e., from the consumption of fish) are relatively limited.

1.7.1.3 Protecting Human Health

Total annual expenditures for the priority items in protecting human health are estimated at $60,000. The three priority items are as follows:

Action 1. Encourage the States and Federal Government to Provide Funds to Implement the Safe Water Drinking Act (a Highest Priority action)

Action 2. Investigate Areas with Potential Contamination Problems Due to Faulty Septic Systems and Devise Flexible Solutions to the Problems

Action 3. Develop a Coordinated Approach to Risk Communication

It is estimated that approximately 71% of that amount will be spent in the Vermont portion of the watershed, and 29% in the New York portion. Of the $42,600 spent in Vermont, an estimated 30% would be provided by federal funds, or $12,780. The remainder, $29,820 is estimated as state, local, and private costs. Similarly, of $17,400 in estimated cost to be spent on New York activities, approximately $5,220 would be a federal expenditure and $12,180 would be non-federal.

Susan Kennedy of the NYS Department of Health provided cost data illustrating the fiscal burden on small New York communities in trying to comply with the Safe Drinking Water Act (SDWA) (personal communication: January, 1996.). New York State guidelines indicate that the capital cost for drinking water infrastructure per gallon treated is $2 per gallon for filtering, $1 per gallon for storage, and $5 per lineal foot for pipe. Operation and maintenance costs are estimated to be 10% to 16% of initial construction costs. Looking just at Lake Champlain basin communities in Essex County NY, the drinking water infrastructure needs are as follows: Keene Valley (80,000 gallons/day) $200,000; Keeseville (450,000 gallons/day) $1,000,000; Lake Placid $3.5 million; and Wilmington (150,000 gallons/day) $200,000. At this point it is difficult to distinguish between costs for upgrades that communities would need to do regardless of the SDWA, and those costs specifically related to compliance with the SDWA. According to recent newspaper articles the Lake Placid cost is due almost entirely to SDWA compliance. It is also important to note that these costs are not attributable to the Plan but rather to national legislation. It is possible that the SDWA initiative could result in less costs being incurred by private water systems, businesses, and others that use surface water for drinking water.

Lake Champlain drinking water could be partially valued at $3.2 million annually, considering only its wholesale value, and accounting only for those individuals served by the 11 municipal water districts. Using the same wholesale value for the other two thirds (62%) of Lake Champlain drinking water users unaccounted for by the 11 municipal water districts, the wholesale value of Lake Champlain water would be in the range of $8 million annually.

For Action 2 on faulty septic systems, the goals are to locate problems, devise solutions, and provide technical assistance in targeted areas. Cost of controlling septic system problems will vary by system, but appear to be minimal given the priority's emphasis on flexibility and technical assistance. In the case of summer camps, there appears to be a trend towards increased use of summer homes, with conversion to year-around use becoming more common. That level of use can often exceed the original septic system design specifications. Therefore, a portion of the private sector costs to upgrade private systems will be related to necessary or planned improvements regardless of the activity related to this priority.

Action 3 on coordinated risk communication does not appear to have any private sector implementation costs.

The principal health risks posed by water pollution in the Champlain basin involve drinking unhealthy water, consuming fish that have accumulated high levels of toxic substances in their tissue, and swimming in water that has been contaminated by pathogens. In terms of drinking water, approximately 156,000 people (32% of the US population of the basin) depend on the Lake for their drinking water. Although the vast majority use public water systems that are monitored and regulated, approximately 4,000 people draw their own water directly from the lake.

Total Lake Champlain fishing expenditures were estimated at $32 million in 1988 (Connelly et al. 1990; Holmes & Associates 1993). If there is a 15% to 33% reduction in angling effort because of fish consumption advisories, as discussed in the literature, the resulting economic loss to local communities could range from $4.8 million to $10.6 million. However, research has shown that fish consumption advisories do not appear to be a major deterrent to fishing, and in fact a majority of anglers are often either unaware that health advisories exist or they choose to ignore the warnings. Therefore, it appears that the economic impact of fish consumption advisories would appear to be at or below the low end of the $4.8 - $10.6 million range.

While the exact number of swimmers who use the lake is not available, the study team estimated that at least 968,000 people visited public and private commercial beach recreation sites on Lake Champlain in 1992. In addition, we know that swimming is an important recreation activity at the approximately 9,000 seasonal homes and at the other year-around homes on the lakeshore. Periodic high levels of fecal coliforms have caused public beach closings along the lake, curtailing swimming activities in certain locations with the resulting adverse economic impact on the local economy. Additional information about these human health concerns can be found in the <u>Background Technical Information for Opportunities for Action</u> (Lake Champlain Basin Program 1996).

Without a detailed analysis of beach attendance and beach closings by date, it is difficult to develop a precise estimate for the economic impact of beach closings. Just by example, the Shelburne VT beach which was closed most of 1995 because of pathogens (possibly related to malfunctioning septic systems) had 500 to 2,000 users per day in 1993. At 3.5 people per user group, that would indicate 143 to 572 families or groups using the beach on a summer day. Using the $26.82 figure for expenditures per group, for each day the beach was closed, expenditures of $3,800 to $15,340 were not occurring in the Shelburne area, assuming that there were no alternative beach sites in close proximity and that the beach remained unused during the closed days. Given those circumstances, the total seasonal lost sales to Shelburne businesses could be in the range of $200,000 to $350,000. For the three beaches closed most of the summer, and the other three beaches closed for 20 days, the lost expenditures in those beach areas could total $650,000 to $1.4 million in 1995. It is likely that a portion of those funds, perhaps half to two-thirds, were spent somewhere else in the Lake Champlain basin as beach users sought out open beaches.

The economic impact of beach closings would appear to go beyond the example given above. When a beach is closed once some visitors choose not to return to that beach for the rest of the year. Similarly, when a "Beach Closed" sign appears repeatedly, another percentage of the user group will choose to travel to a beach that is open more consistently. On a broader public perception level, beach closing notices give the impression that the lake is somehow polluted regardless of the localized nature of the problem. For a segment of the population use of any beach on the lake, or lake use in general may be curtailed.

In terms of the third priority action, clarifying risks, coordinating messages, and reducing confusion would lead to some level of increase in angling on Lake Champlain. Charter boat captains especially feel that the current advisories deter people from fishing Lake Champlain, and that they are on their own in trying to explain that the risks can be minimized through location fished, species caught, and in some instances fish cleaning techniques.

1.7.2 Living Natural Resources

1.7.2.1 Managing Fish and Wildlife

The high priority action is a recommendation to: Identify and Restore Habitats and Conserve Vulnerable Habitat Corridors. Total annual expenditures for the high priority item is estimated at $100,000. It is estimated that approximately 71% of that amount will be spent in the Vermont portion of the watershed, and 29% in the New York portion. Of the $71,000 spent in Vermont, an estimated 70% would be provided by federal funds, or $49,700. The remainder, $21,300 is estimated as state, local, and private costs. Similarly, of the estimated $29,000 cost spent on New York activities, approximately $20,300 would be a federal expenditure and $8,700 would be non-federal.

According to the description of the action, non-regulatory measures related to identifying and restoring habitats would be initiated with willing landowners. One of the federal programs for wetlands protection, Partners for Wildlife, requires a 30% cost share. It is expected that the willing landowners expect to recognize both tangible and intangible benefits that will exceed the cost. Other than the cost share requirements, this action does not appear to have any private sector implementation costs.

Fish and wildlife recreation activities are popular both to local residents and to tourists who visit the Lake Champlain basin. In 1990-91, anglers purchased nearly 108,000 fishing licenses in the Vermont area of the basin, and 60,000 licenses in the New York area of the basin. About 35% of licenses were purchased by nonresidents of the basin. Approximately 41,000 anglers licensed in New York fished Lake Champlain approximately 482,000 angler days in 1988 and spent approximately $9.5 million ($19.61 per day) in the area of Lake Champlain (Connelly and Brown 1988). Holmes & Associates extrapolated Vermont angler activity based on the New York data and calculated total angler activity on Lake Champlain at 1.6 million angler days and $32 million in expenditures at Lake Champlain[1].

A total of 35,788 hunting licenses were sold in the New York area of the basin in 1993. Statewide, Vermont had an estimated 107,162 hunting license holders in fiscal year 1992. Waterfowl hunting resulted in $2.5 million in expenditures in Vermont in 1980, most of which occurred in the Lake Champlain basin (Gilbert 1985). Trapping of furbearers contributed another $500,000. Berry picking and gathering plants for consumption or decoration also occurs. Nonconsumptive wildlife activities such as observing, feeding, and photographing wildlife are also very popular in the Lake Champlain basin. Approximately 62% of Vermont residents participated in these activities away from their residence in 1991 (U.S. Fish and Wildlife Service 1993).

Taken together, these hunting, fishing, gathering, and wildlife observation activities all depend on natural resources and protected habitats. A study that looked at the total value of all fishing and hunting activities to the state of Vermont found that in 1980 durable and nondurable expenditures totaled $173.7 million dollars and contributed $6.5 million in sales tax revenue to the state.

Additional discussion of the economic benefits derived from fish and wildlife is provided below in the section on protecting wetlands. As pointed out in "Opportunities for Action," the 300,000 acres of wetlands provide critical habitat and nourishment for fish and wildlife. Therefore, the protection of wetlands has direct bearing on the economic benefits of managing fish and wildlife.

Direct use economic benefits would be related to improved conditions for both consumptive and nonconsumptive users of fish, wildlife, and other natural resources. Increased opportunity to catch fish, bag a goose, or view a bald eagle all translate to increased user satisfaction, increased use levels, and increased expenditures in local communities around the basin.

Private landowner cooperative programs with the U.S. Fish and Wildlife Service have generally been popular with landowners in the Northeast and have led to mutual benefits for the landowner and for fish and wildlife conservation. In the Lake Champlain basin, such programs could also contribute to improved water quality by implementing practices that reduce erosion and control nonpoint source pollution. Thus, expansion of this program is likely to produce tangible benefits.

Working with private landowners to reduce runoff and erosion into streams and rivers could have potential benefits for recreational fishing in the lake. An Indiana study found that 1% to 15% reductions in suspended solids and associated pollutants may provide net benefits of $250,000 to $5.5 million to recreational anglers (Patrick et al. 1991). However, in the Indiana example, achieving those benefits required a substantial reduction in erosion from cropland. Recreational fishing is the only consumptive use activity for which accurate Lake Champlain-specific expenditure data is available. The $9.5 million spent in the vicinity of the lake by New York anglers using Lake Champlain was extrapolated to $32 million when Vermont angler expenditures are included (Holmes & Associates 1993). A 1% increase in angler effort and related expenditures due to this action would add $320,000 in sales to local businesses, a 5% increase would add $1.2

1 Holmes & Associates incorrectly reported 5.1 million angler days and expenditures of $81 million in the Preliminary Economic Analysis Report, Part 2 (1995). An error was made in converting anglers to angler days.

million. However, some of this increase could be simply a shift in expenditures from other types of locally produced goods and services.

In terms of non-market benefits, Kealy & Bishop (1986) found that improved fishing in Lake Michigan was valued by anglers at an average of $28 per trip in 1995 dollars. With an estimated 1.4 million fishing trips on Lake Champlain the benefit to anglers could be as high as $39 million annually. A 1% increase in fishing effort could yield additional benefits of $390,000, while a 10% increase would have a resulting benefit to anglers of $3.9 million.

Non-use benefits would be economic benefits that accrue to those who never fish, hunt waterfowl, or observe birds or wildlife. While difficult to document, the value of just knowing that a particular bird or animal species exists is evident in the popularity of "save the whale" campaigns, protecting the spotted owl and other national and international environmental protection efforts. Many individuals "value" those animal species knowing full-well that it is unlikely they will ever see one. More tangible non-use benefits to residents of the Lake Champlain basin include increased property values, ability to attract high tech industry because of improved quality of life and recreation opportunity, and other benefits to citizens and business because of the perception that the basin has a cleaner or more pristine environment.

1.7.2.2 Protecting Wetlands

Annual expenditures are to be determined. Phase One of the Strategy is underway with $630,000 obtained from the North American Wetlands Conservation Act and other sources to be used in protecting 1,500 acres of wetlands. An additional 7,500 acres is recommended for protection in the subsequent three phases. As with Fish and Wildlife actions, land acquisition and restoration activities would be initiated with willing landowners.

In general, for lake edge wetlands and some riverine wetlands linked to deltas and river openings to the lake, benefit flows include: water quality maintenance, storm surge protection/shoreline erosion reduction, non-consumptive recreation, consumptive recreation, public accessible aesthetic values; habitat for fish amphibians, water birds, and some mammals which is linked with consumptive recreation above such as hunting, fishing and fur trapping, plus existence values; and amenity waterfront land value adjacent to wetlands.

For more inland palustrine and riverine wetlands within the watersheds and sub-watersheds feeding Lake Champlain, water quality maintenance/erosion control is a major potential benefit followed closely by flood control amelioration. Other benefits include some consumptive recreation such as stream fishing and hunting, non-consumptive recreation and private amenity values to property owners. Habitat values are quite different from lake edge wetlands. Habitat is more critical for amphibians, song birds, mammals and some water birds with consumptive values linked to hunting and fur trapping. There also may be cases of adjacent agricultural development (temporary) and forestry activity.

In terms of basin-wide habitat protection, there are three types of benefits. The first category includes the public benefits which accrue to the different user groups recreating on the lake or lake edge, e.g. motor boating, sailing fishing, hunting, nature observation, hiking, etc. The second category involves benefits to private landowners who own wetlands at the lake edge or upland. These are termed amenity values which is the aesthetics the private property owner enjoys from his or her wetland area and much of that is observing wildlife. The third benefit category, which is the most difficult to quantify, is use of wetlands by individuals engaged in subsistence activities (e.g. hunting, fishing, trapping or gathering food/fiber plant materials) legally or illegally on wetland property. Although this is very difficult to quantify (Ellana and Wheeler 1989), we know it occurs in rural upland and coastal areas in Vermont and New York State.

It order to realize the benefits of wetlands it is important to develop incentives for local municipalities, provide landowners and community based organizations/management organizations (CBO/NGO's) such as land trusts to protect, restore and enhance wetlands. Tax incentives will be very difficult to improve upon, as the land value of wetlands is so low to start with, and there have been severe problems with implementation of forest land tax incentives in New York state. A better plan is to push multi-objective floodplain management/water quality improvement at the local level to realize values of averting flood damage, water quality maintenance/ erosion control, habitat and open space benefits. The other part that needs to be stressed is the potential role of not-for-profit NGO's such as local land trusts to help coordinate actions such as land acquisition at the local level where the focus would be natural resource management at the sub-watershed/floodplain level, plus connection of habitat fragments along rivers, streams and wetland systems.

The feasibility of establishing a Mitigation Banking Program for wetlands in the Lake Champlain basin should also be explored. There is guidance at the Federal level for wetland banking but we need to look at what makes sense for New York and Vermont within the basin. Wetland banking systems are most effective as part of more comprehensive watershed protection plans or areawide wetland studies (Bedford 1990) In this way banking systems would not aggravate already stressed situations and creation/restoration priorities will be clear regarding optimum banking sites.

This action has a number of non-use benefits, including water quality maintenance, storm surge protection/shoreline erosion reduction, and amenity waterfront land value adjacent to wetlands. As with most non-use benefits, it is difficult to differentiate their impact on the human population of the basin from that of other environmental, ecological, and economic activities. Contemporary environmental protection approaches are focusing on the most valuable and the larger tracts of wetlands and other environmentally important areas, and thereby maximizing both the environmental and economic benefits. That approach appears to maximize both use and non-use economic benefits by recognizing that not all wetlands are of equal value and do not all need the same level of protection. The Lake Champlain Wetland Acquisition Strategy provides a solid basis for making those types of distinctions.

1.7.2.3 Managing Nuisance Nonnative Aquatic Plants and Animals

The high priority action is a recommendation to: Develop and Implement a Comprehensive Management Program for Nuisance Nonnative Aquatic Species in the Lake Champlain basin (1 of 3 Highest priority actions). Total annual expenditures for the high priority item is estimated at $100,000. It is estimated that approximately 71% of that amount will be spent in the Vermont portion of the watershed, and 29% in the New York portion. Of the $71,000 spent in Vermont, an estimated 50% would be provided by federal funds, or $35,500. The remainder, $35,500, is estimated as state and local costs. Similarly, of the $29,000 in estimated costs to be spent on New York activities, approximately $14,500 would be a federal expenditure and $14,500 would be non-federal. This action does not appear to have any private sector implementation costs.

Nuisance aquatics cause recreational use problems that can be clearly linked to economic impacts. As pointed out in the Plan, "attacks by adult sea lamprey on salmon, lake trout, and other fish species have limited full development of a Lake Champlain fishery, and restricted recreational and associated economic opportunities" (Lake Champlain Basin Program 1996a). The successful, cooperative program to combat sea lamprey on Lake Champlain, including joint efforts by federal agencies, New York State, and Vermont, is illustrative of the type of cooperative remediation efforts among Vermont, New York, and Quebec recommended in many other sections of the Plan.

In addition to the past and on-going economic and environmental problems resulting from sea lamprey, Eurasian watermilfoil, water chestnut, flowering rush, purple loosestrife and now zebra mussel are nuisance species around Lake Champlain. The zebra mussel is a very recent inhabitant of Lake Champlain's waters and its economic impacts are already being felt by drinking water suppliers, lakeshore homeowners, and boaters. Recent findings and estimates of the potential economic impacts of the zebra mussel on Lake Champlain businesses and communities are outlined in the report.

There are direct use benefits related to controlling aquatics. As discussed in detail, zebra mussels have a direct, adverse economic impact on a wide variety of lake users including drinking water suppliers, industry, fish hatcheries, small businesses, lakeshore home owners, and boat owners. Because zebra mussels are a recent arrival to Lake Champlain and the United States, the information gathering aspect of the priority action is very important. It appears avoidance of all costs related to zebra mussels is unlikely, however, this action should result in cost savings to lake water users by identifying the most cost effective zebra mussel controls available.

In terms of the Sea Lamprey Control Program, an additional 65,000 angler days as a result of the program. Using Connelly and Brown's (1990) estimated expenditure of $19.61 spent per angler day on Lake Champlain, the economic impact in local communities would be at least $1.3 million annually. Anglers targeting salmon and lake trout tend to spend more than the average angler, so the economic benefits will likely be higher. While this action does not include the annual costs of monitoring the success of the sea lamprey control, it does involve a degree of coordination and evaluation of that program.

Where there are large infestations of water chestnut plants, boating and boat access to shore sites is curtailed or prevented. Marina owners in the southern portion of the lake report that beds of water chestnut plants limit access to their facilities and adversely impact their business.

Impacts on tourism and recreation from this action include accurate information going out to the public on how zebra mussels may affect their use of the lake, an increase in fishing related to sea lamprey control, and potentially improved boating in the southern portion of the lake related to water chestnut control as coordinated by the activities under this action. Presently, the three nuisance aquatics are acting to limit tourist and recreation expenditures around the lake. Activities related to their control should slow or reverse that trend.

1.7.3 Recreation and Cultural Resources

1.7.3.1 Managing Recreation

The one high priority actions is to: Develop and Implement a Strategy to Provide New Public Access Opportunities. Total annual expenditures for the high priority action is estimated at $50,000. It is estimated that approximately 71% of that amount will be spent in the Vermont portion of the watershed, and 29% in the New York portion. Of the $35,500 spent in Vermont, an estimated 10% would be provided by federal funds, or $3,550. The remainder, $31,950 is estimated as state, local and private funding. Similarly, of the $14,500 in estimated costs to be spent on New York activities, approximately $1,450 would be a federal expenditure and $13,050 would be non-federal.

The high priority recreation action does not appear to have any private sector implementation costs. This action would be accomplished Primarily by the state parks and fish and wildlife agencies in New York and Vermont. This consists of first finishing an access strategy (locating potential sites on a priority basis and securing the sites) and then developing state grant programs to help local entities develop the needed access facilities.

Because the majority of the funds involved would be state funds, the cost of additional public facilities would not be overly burdensome on local residents. Costs of administering the facilities and annual maintenance costs are not expected to be large.

As is true of the rest of the nation, the Lake Champlain basin has rapidly evolved into a service-oriented economy, with one-third of total employment in the service industries in 1990. Outdoor recreation and tourism constitute a major portion of the service economy of the region, and a significant portion of the total economy. Total tourism-related expenditures in the basin were estimated at $2.2 billion in 1990 (Holmes & Associates 1993). A maximum of $880 million, or about 40% of the basin-wide total expenditures, occurred in Lake Champlain shoreland towns. Within those shoreland towns there were as many as 16,400 tourism related jobs. Lake Champlain itself was determined by this research to directly generate at least $123 million in tourism expenditures, resulting in 5,654 jobs.

Specific business beneficiaries of Lake Champlain-related tourism and recreation include marinas, sporting goods stores, restaurants, camp grounds, hotels, etc., virtually the gamut of tourism related businesses. The international flavor of Lake Champlain, and the cooperative tourism efforts already underway, especially within the US\Canadian corridor along Missisquoi Bay and the Richelieu River, make the basin one of the more appealing tourist destinations in the Northeastern U.S. The Richelieu Valley region of Quebec has been working to stimulate tourism inter-regionally by emphasizing outdoor opportunities, cultural heritage resources, and the surrounding ecotourism activities provided by the natural, historical, and cultural similarities around the Lake Champlain and the Richelieu River basin areas.

Much of the challenge in recreation management is in providing additional recreation opportunities in ways that do not significantly worsen water quality. Few studies anywhere in the world have established definitive quantitative relationships between recreation activities, tourism visitation, and water quality. Certainly at some levels or ranges these relationships exist. However, the relationships typically are not linear, and the findings concerning one water body are not necessarily exportable to another water body.

While public access is key to use of the lake and the related expenditures, we can not be certain how much new, improved, and expanded public recreation access sites will contribute to increased use. There is evidence of over-crowding at some of access sites on the lake, indicating that there may be users who are foregoing boating or are traveling to other lakes rather than waiting in line. However, on the major holidays and other peak boating days it is likely that crowding is an issue on many of the lakes in the basin.

Quality facilities are key to competing for the tourist dollar, so well-planned access improvements should pay dividends in the future. For example, based on an estimated $47 million in expenditures related to the use of public access on Lake Champlain for boating and fishing, a 1% increase in use would result in an additional $.5 million in expenditures, a 5% increase would result in $2.4 million added to the economy, and a 10% increase in use would lead to an additional $5 million in expenditures.

Developing a joint New York and Vermont Lake Champlain fishing license agreement is one of the recommendations within this section of the Plan. Although an in-depth benefit-cost analysis of that proposal has not been undertaken, it would appear to be a positive development for anglers and the fishing economy around the Lake. The lake-wide fishing license could possibly be initiated as an add-on option to the regular license -- in the form of an illustrated stamp -- as is commonly done with different hunting license options. Using that approach, anglers would continue to buy a fishing license for their state of residence as at present, then pay an additional few dollars for the Lake Champlain stamp that would allow them to fish anywhere on the lake. If the funds from sale of the stamp could be directed to Lake Champlain fishing-related programs, it is likely that the support for the stamp would be widespread and that the income would more than offset the loss of current fishing license sales to those New York and Vermont anglers who want to fish the other side the lake.

1.7.3.2 Protecting Cultural Heritage Resources

The one high priority action is to: Develop and Promote Locally Planned, Approved and Managed Networks of Heritage Trails and Programs around the Lake. Total annual expenditure for the cultural heritage high priority item is estimated at $25,000. It is estimated that approximately 71% of that amount will be spent in the Vermont portion of the watershed, and 29% in the New York portion. Of the $17,750 spent in Vermont, an estimated 20% would be provided by federal funds, or $3,550. The remainder of $14,200 is estimated as state, local and private funding. Similarly, of the $7,250 in estimated costs will be spent on New York activities, approximately $1,450 would be a federal expenditure and $5,800 would be non-federal.

The costs of protecting, maintaining, and operating cultural heritage sites seldom fall entirely within the public sector. The efforts are often partnerships between the public and private sectors, with foundation grants and private donations traditionally providing a significant portion of the necessary funds. Significantly, user fees (i.e., cost of admission) are more common and accepted with visits to cultural heritage sites, than perhaps with any other type of recreational activity. People expect to pay a few dollars to visit a museum, historic site, or interpretive center, and will often make a donation and buy a gift or souvenir to help support the site.

Cultural resources in the basin, especially those on the lakeshore, remain closely linked to Lake Champlain. The Plan helps to clarify the government's role as a catalyst in protecting and promoting cultural resources by recommending actions related to these locally valuable resources. The relatively low cost of the recommendations in this section of the Plan reflects the fact that cultural resources by and large pay their own way, traditionally relying on user fees and private sector grants to cover the expense of facility development, operation and maintenance.

This research estimated that visitors to historic sites within three miles of Lake Champlain made expenditures in the area totaling at least $4 million. That amount underestimates the total economic impact on the basin economy of cultural heritage tourism because existing data does not include the economic impact of visitors to non-admission based historic sites, such as historic downtowns, villages, and historic districts.

The design of many communities was originally oriented towards the lake because Lake Champlain was the source of their economy and commerce, as well as their transportation link to the outside world. More common these days are lakeshore areas where the backs of buildings face the lake and where visitors are discouraged from walking and exploring along the lake front. As specific areas of Lake Champlain are targeted for phosphorus reduction and environmental remediation, and as others benefit indirectly from a cleaner lake, lakeshore communities will begin to see increased economic opportunities in once again looking out over Lake Champlain, providing access to the lakeshore for visitors and residents alike, and capitalizing on what the lake and shoreline have to offer. Values to be capitalized on include recreation and transportation uses as well as cultural and historic resources. The City of Burlington's considerable investment and effort to improve its waterfront, including protection of historic buildings and development of a Lake Champlain Science Center is a case in point and represents the economic link between the lake, cultural heritage and local economies.

As discussed throughout the Cultural Heritage section of the Plan, historic districts and other cultural heritage resources have many non-monetary benefits to a community and a region. These resources serve to link people to each other and to their community by providing continuity to human activities in the area. This sense of community and sense of place are main ingredients for enjoyable communities and satisfying lives. The educational value of these resources is also difficult to quantify monetarily, even though the enjoyment and learning offered by the cultural and historic sites to thousands of school children is obvious and significant.

The direct use economic benefit will be increased use and expenditures related to historic and cultural sites because of the improved information made available to the public. Although there are a few large cultural heritage sites that receive over 100,000 visitors a year, many of the small sites are under-utilized at only 20 percent of capacity or less. The high priority action will result in valuable promotional and marketing tools, such as development of theme tours, that will direct the visiting public to many of the smaller related sites throughout the basin.

Secondary benefits will result to the visiting public who will have an enhanced cultural heritage tourism experience when the promotions, brochures, and maps are made available. Additional benefits include the enhancement of cultural heritage sites for small communities by coordinating technical skills and financial resources to do regional promotion.

1.8 The Cost of No Action

The direct benefits of water quality improvement in Lake Champlain, or alternately the costs of water quality degradation that could result from no action, are quite diverse. They include recreational and/or health benefits for anglers, swimmers and boaters; aesthetic benefits for both local residents and visitors; and the bequest and existence values that residents within the basin and elsewhere might place on a cleaner lake. These benefits are quite difficult to quantify even based upon studies designed for and conducted within the Lake Champlain basin. Benefit estimates developed by transferring per household or per user values from studies in other regions to Lake Champlain can only provide a preliminary indication of the range of potential benefits of water quality improvements.

Benefit estimates gleaned from over 50 studies of the economic benefit of water quality improvement indicate the benefits of water quality improvement on Lake Champlain would range from $13 million to an upper bound of $63 million per year. That is the estimated value that lake users would receive from improved water quality. That type of economic benefit is in addition to any increase in the estimated $123 million in Lake Champlain dependent expenditures described above.

In addition to those benefits to general recreational users of the lake, water quality improvement or avoidance of water quality degradation would provide benefits to lakeshore property owners. The study by Feather et al. found significant property value impacts due to water quality changes up to a mile from the lakes included in that study. The several hedonic valuation studies summarized in this report indicated property value impacts in the range of 10% due to changes in water quality similar to those that might result in Lake Champlain from implementation of the Plan. The total assessed value of real estate in Vermont lakeshore towns in 1991 was approximately $7.2 billion and for New York shoreland towns the assessed value of real estate was $1.6 billion for a total assessed value of $8.6 billion (Holmes & Associates 1993). Using a conservative estimate that 5% of this assessed value of real estate in lakeshore towns is attributable to lakefront property, then a 10% change in value in this lakefront property due to water quality changes (positive or negative) would equate to an economic impact of $43 million. Since real estate prices capitalize the use value of a property over time, this benefit (or avoided cost) of water quality improvement would be a one time rather than an annual benefit.

Regardless of whether it is market or nonmarket benefits and costs that are being considered, the public's understanding of benefits and costs of Lake Champlain activities would be enhanced by clear definitions of the terms. Anthony Artuso, Ph.D. economist on the study team, developed the following working definition of costs and benefits for use in analysis and dialogue on the economic aspects of the Lake Champlain planning effort.

> In analyzing environmental protection and restoration programs the definitions of costs and benefits should be constructed both comprehensively and carefully. First, it is essential to be clear about the geographic perspective from which costs and benefits are defined. Federal funding for Lake Champlain environmental protection programs would be viewed as a cost at the national level, but should be counted as a benefit if the analysis is being conducted from a regional perspective. In addition, it is essential to use a consistent baseline in measuring costs and benefits. For example, if costs of environmental protection efforts are defined in relation to a no action alternative, then benefits must also be calculated in relation to the environmental and economic conditions that would have existed if no action were taken.
>
> The following definitions are intended to define the categories of potential costs and benefits of the Lake Champlain Pollution Control and Environmental Restoration Plan from a national perspective in relation to a no action alternative.
>
> **COSTS**
> Direct costs of environmental protection or restoration efforts include capital, operating maintenance and administrative expenditures by both the public and private sector. Indirect costs include any reduction in profits in excess of the direct costs of pollution control as well as a portion of lost wages due to any increase in unemployment. Only a portion of lost wages represents a true cost since unemployed workers will find other productive, although not necessarily equally valuable, uses for their time such as continuing their education or providing additional care to family members. In estimating indirect costs or multiplier effects it is important to recognize that environmental protection efforts may reduce output or employment in one industry while increasing it in others. These partially or fully offsetting gains in other sectors of the economy must therefore be subtracted from indirect costs or included as benefits.

BENEFITS

The direct benefits or avoided costs of environmental restoration and protection efforts can include increased recreational enjoyment and aesthetic appreciation, reduced public health risks, and increased profits or consumer benefits from direct commercial uses of environmental resources (e.g. sale of fish caught on the lake). Direct recreational and aesthetic benefits of environmental programs are often capitalized in the form of increases (or avoided reductions) in property values in the affected area. Benefits of pollution control or remediation efforts that enhance public health can be quantified in the form of reduced medical costs and increased productivity. However, the benefits of water pollution control efforts that protect or restore public water supplies should be measured by the avoided or reduced costs of water treatment.

In addition to these direct use benefits of environmental protection, there are potential non-use benefits related to changes in option, existence and bequest values. Option value is simply the value to the individual of preserving the opportunity to use a clean environment and is therefore closely related to, but nevertheless conceptually distinct from, direct use benefits. Bequest values are based on the satisfaction that individuals derive from knowing their children, or future generations in general, will be able to enjoy a clean environment. Existence value is any additional satisfaction, apart from direct use, option, or bequest values, that individuals receive simply from knowing that an important ecosystem, natural area, or endangered species has been protected.

Environmental protection efforts will also generate beneficial multiplier effects. Purchases of pollution control equipment and operation of pollution control programs will increase output and employment in certain sectors of the economy. Multiplier effects should also be taken into account if environmental programs are expected to lead to increases, or avoid reductions, in tourism and recreational expenditures. The benefit of these multiplier effects should be measured by the increase in before-tax profits of local businesses, as well as the portion of increased wages in excess of the value of leisure time. As noted above, beneficial multiplier effects for some sectors of the economy must be considered in relation to negative multiplier effects that environmental regulation and pollution control costs may create for other sectors.

The public choice of continuing to protect and improve the water quality of Lake Champlain, versus taking no action in terms of reducing nutrient pollution, could be viewed in private sector terms as protecting an investment and expanding the basin's economic potential. On the cost side, taking no action could be viewed as deferring or externalizing pollution control costs to a later date and a future group of customers. Costs of phosphorus control will likely increase in the future, while the current costs to phosphorus dischargers could be considered as artificially low in terms of the costs for achieving the in-lake phosphorous levels recommended by the Plan.

The relatively clean water of Lake Champlain is a valuable, limited commodity that serves multiple uses including recreation, drinking water, industrial uses and aesthetic enjoyment. As evidenced in lake and coastal areas around the country, waterfront areas are valuable assets, however, their value hinges on the quality of the water along shoreline areas. The cost of cleaning and purifying water for those uses increases as the water quality decreases. By doing nothing and refraining from making any public investment in Lake Champlain, its economic and social values will deteriorate as with any neglected public or private property, and the costs of future clean-up will be greater than at present.

According to data compiled for this research, a conservative estimate is that Lake Champlain annually generates at least $123 million directly in the basin economy in the form of recreational activity. In addition, this research has identified at least three other economic benefit categories related to the Plan.

1. Other direct benefits to users as extrapolated from benefit estimate studies are in the range of $13 to $63 million annually.
2. There is also a one time property value benefit, or avoided cost, of perhaps $43 million.
3. Estimates of increased jobs and economic activity as generated from the IMPLAN analysis indicate $9.7 million in total valued added related to Plan implementation in Years 1 - 5, $6.3 million in Years 6 - 10, and $6.4 to $19.4 million in Years 11 - 30.

Given this array of benefits, doing nothing to protect and enhance Lake Champlain does not appear to be economically in the best interest of the residents and businesses of the basin. The issue then becomes how to most efficiently and most equitably distribute the costs and benefits of maintaining and improving Lake Champlain. The economic analysis report provides guidance in that direction.

1.9 Conclusion

Now that the Lake Champlain Basin Program staff and the Lake Champlain Management Conference have developed physical science research findings into policy recommendations in the Plan, a next step in illuminating the human aspects of the policy recommendations is to translate their implications for the communities throughout the basin. Economics provides one way making that translation. The social scientists involved in this research used economic tools and concepts to illuminate the economics of phosphorus control and the other environmental and social priorities in the Lake Champlain basin.

Environmental concerns such as those discussed in the "Opportunities for Action" are essentially human issues, encumbered with a diversity of political, economic, social, and cultural ramifications. In their deliberations and decision making, the LCMC and the public are considering the varied ramifications of each Plan recommendation as they evaluate the recommendations on a number of criteria, including the degree of public support, the reliability of possible funding sources, and the cost effectiveness of the element in addressing a particular Lake Champlain issue. That type of public consideration and evaluation is crucial to developing a sustainable Lake Champlain protection and restoration effort.

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Glossary of Economic Terms and Concepts

Benefit (Recreation) - A proxy for the economic value of all the psychological satisfactions from outdoor recreation activities. This is identical to a widely accepted meaning of the economic term "utility" (Walsh 1986:44-45). Total benefit is the maximum amount of money consumers would be willing to pay rather than give up the recreation activity (Walsh 1986:130).

Benefits Transfer - The use of information from existing nonmarket valuation studies to develop value estimates for another valuation problem. In can reduce both the calendar time and resources needed to develop original estimates of values for environmental commodities (USEPA Policy, Planning, and Evaluation 1993:3).

Benefit Valuation (Economic) - Measuring in dollars how much the people affected by some policy will gain from it. They are not forecasts, and they usually do not attempt to predict other exogenous influences on people's behavior. Instead, a predefined set of conditions is assumed to characterize the nonpolicy variables. Then benefit estimates are derived by focusing on the effects of the conditions assumed to be changed by the policy (USEPA Policy, Planning, and Evaluation 1993:45).

Bequest Values - Bequest values are based on the satisfaction that individuals derive from knowing their children, or future generations in general, will be able to enjoy a clean(er) environment.

Carrying Capacity - The maximum population of a given species which a particular habitat can support indefinitely (under specified technology and organization, in the case of the human species).

Cost/Benefit Analysis - Ratio of dollar cost of project to dollar benefit it will produce, used to compare worthiness of various proposed projects.

Comprehensive Income - An economic measure of the total benefits from all life's activities, including recreation. It is the sum of how much consumers would be willing to pay for each of life's activities rather than forego them. There are four components of comprehensive income: (1) the market value of goods and services that consumers purchase with dollars from regular income or savings; (2) the willingness to pay for self-sufficiency goods and services that consumers produce for themselves; (3) the opportunity cost of leisure time that consumers commit to the activities; and (4) the consumer and producer surplus to individuals, representing the net benefits of all life's activities over and above consumer costs in dollars, effort, and time (Walsh 1986:57).

Consumer Surplus - The value to consumers of the opportunity to buy units of a good at a particular price. In terms of recreation, the value that participants derive from the recreation activity above and beyond what the actual spend on the activity. Asking people what they are willing to pay is a way of assigning dollar values to this consumer surplus and obtaining a more complete estimate of how much the recreation activity is worth to the participants (Vermont Department of Forests, Parks, and Recreation 1995). (see also: Recreation Benefit Valuation, Willingness to Pay).

Contingent Valuation Approach - As a method of providing acceptable economic measures of the benefits of recreation activities and resources, this approach relies on the stated intentions of a cross-section of the affected population to pay for recreation activities or resources contingent on hypothetical changes in their availability depicted in color photos or maps. The values reported represent the maximum willingness to pay rather than forego the recreation opportunity or resource (Walsh 1986:195).

Culture - A system of socially acquired and transmitted standards of judgment, belief, and conduct; the total set of beliefs, customs, or way of life of particular groups.

Demand (marginal benefit) - The quantity of any particular commodity that will be purchased on a market or groups of markets at a given price or series of prices.

Diminishing Marginal Utility - As the amount consumed of a good increases, the extra utility added by one extra last unit (or marginal utility) tends to decrease.

Existence Values - Existence value is any additional satisfaction, apart from direct use, option, or bequest values, that individuals receive simply from knowing that an important ecosystem has been protected. Also referred to as nonuse values.

Externalities (External Costs) - Costs of production that fall on others and for which the producer bears no financial responsibility; uncompensated adverse effects usually borne by others.

Fiscal Capacity and Fiscal Effort - The ability of a government unit to raise tax revenue is generally referred to as its "fiscal capacity". The fiscal capacity concept is generally conceived in relative rather than absolute terms, for there is no universal, agreed-upon benchmark against which a local government's fiscal situation may be compared. Rather, the situation of a given government unit is compared to the norm among like units. A related concept, "fiscal effort," measures the extent to which a given local government is imposing taxes compared to other local government units. Typical uses of fiscal capacity and effort indices include monitoring the fiscal health of governments, distribution of intergovernmental aid, and tax or debt limits.

Hedonic Pricing - Hedonic price analysis utilizes a statistical technique known as multiple regression to estimate the property price effects attributable solely to variations in local environmental quality.

Household Production - Household production refers to the fact that consumers provide inputs of time and effort as well as dollars. Economists suggest that there is an implicit market within each household. Recreation activity is produced by households (i.e., consumers), with purchased goods and services, as well as their own self-sufficiency, leisure time, and other inputs that are publicly provided such as park facilities and a natural environment (Walsh 1986:57).

Hypothetical Behavior Valuation Methods - The contingent valuation approach is the primary "hypothetical" behavior method for assigning nonmarket values.

Intergenerational (or Intertemporal) Transfer - Economic decisions based on the perceived needs of future generations.

Leisure Time - Discretionary time to be used as one chooses.

Margin - The point at which the value of an added output equals the value of the unit of input that produced it; the point of maximum net return.

Marginal Benefit - The change in total benefit resulting from a change in the number of trips. It is the willingness to pay for an additional trip. The concept of diminishing marginal benefit states that as consumers take more and more trips, other things being equal, the benefit of each additional trip will decrease (Walsh 1986:130).

Nonmarket Good Valuation - Assessing the value of a good or service which is not traded in the market place and has no market value. Because it is not bought and sold some other measure than price must be used in establishing the value.

Nonuse Values - For wetlands, defined as the value derived from preservation independent of on-site or off-site use (Stevens et al. 1995). (also see existence value).

Observed Behavior Valuation Methods - Travel cost and hedonic pricing are examples of "observed" behavior methods for assigning nonmarket values.

Opportunity Costs - The return to the best alternative use by employing a unit of resource in a given manner.

Option Value - Option value is simply the value to the individual of preserving the opportunity to use a clean environment and is therefore closely related to -- but nevertheless conceptually distinct from -- direct use benefits. The annual payment of a kind of insurance premium to guarantee the possibility of future recreation use (in addition to the expected benefits of direct and indirect use)(Walsh 1986:85).

Recreation - Leisure time activity such as swimming, picnicking, boating, hunting, etc.; use of leisure time for personal satisfaction and enjoyment, a basic human need; an exceedingly variable term meaning almost anything people do with their leisure time.

A distinguishing characteristic of recreation is that individuals are producers as well as consumers of recreation activity. The individual consumer produces recreation days with a desired set of characteristics by combining: (1) his/her own inputs of knowledge, skill, and effort with nonmarket work time; (2) purchased goods and services produced by others; and (3) other inputs that are publicly provided such as a state park or reservoir (Walsh 1986:30).

Recreation Benefit Valuation - Total benefits are defined as the maximum amount that individuals would be willing to pay for a recreation activity -- a nonmarket good -- rather than forego it. Net benefits are total benefits less direct costs. As such, net benefits to consumers are analogous to net profits to business firms. In both cases, the value of the activity is determined by what is left over after all costs are met. Yet, some confusion results form the fact that the net benefits to consumers are not paid to anyone and thus do not appear in national accounts (Walsh 1986:59).

Recreation Day - A visit by one individual to a recreation area for recreation purposes during any reasonable portion or all of a 24-hour period of time. One person participating in an activity for any part of one calendar day (Walsh 1986:68).

Recreation Visitor Day (or User Day) - 12 person hours, which may be one person for 12 hours, 12 persons for one hour each, or any equivalent combination of individual or group use, either continuous or intermittently (Walsh 1986:68-69).

Secondary Data Analysis - Data collected and processed by one researcher are reanalyzed - Often for a different purpose - by another.

TP - Total phosphorus. In lake total phosphorus concentrations for Lake Champlain vary from 15 μg/l for the Main Lake, to 52 μg/l for the South Lake.

Travel Cost Approach - Used to estimate the value of recreation. Traditionally preferred by most economists because it is based on observed market behavior in a cross-section of users in response to direct out-of-pocket and time cost of travel. The basic premise of the approach is that the number of trips to a recreation site will decrease with increases in distance traveled, other things remaining equal. When determining the opportunity cost of work or leisure activities that are foregone for travel to and recreation at the site, this approach supports that both travel and on-site time costs can be added to direct travel costs to determine the willingness to pay (Walsh 1986:94,195).

Trophic State Index (TPI) - Indicates a measure of the extent or condition of eutrophication in a body of water.

Unit Day Value Approach - Relies on expert judgment to develop an approximation of the average willingness to pay for recreation activities. An estimate is selected from a range of values approved by federal guidelines. Initially based on a survey of entrance fees at private recreation areas in 1962, the unit day values recommended by the guidelines have been adjusted for changes in the consumer price index since then (Walsh 1986:94,195).

Use Value - For wetlands, economic value related to recreation, flood control, ground-water recharge, and water quality (Stevens et al. 1995).

Utility - The ability of a good to satisfy human wants.

Value Added -Value added is the sum of payments made by industry to produce their products and services. Simply, these payments consist of: payroll to workers (labor); payments for capital used to finance operations (interest), payment of profits to owners (rents); and indirect business taxes (primarily excise and sales taxes). These payments are the difference between the dollar value of the product and services sold and the expenses incurred by industry to produce them. In other words, for each firm value added is the market value of each firm's output less the value of the inputs it has purchased to produce its output.

Willingness to Pay - A dollar measure of benefits, meaning how much individuals enjoy recreation activities. Usually valued over and above expenditures actually made while participating in the activity. The psychological content of benefits includes all of the feelings of pleasure which lead participants to exclaim "what a good time they had" or "what a good buy" or possibly "it wasn't worth it." The latter possibility reflects the fact that recreation economic decisions are made before the fact and that actual benefits may not come up to expectations. Federal guidelines recommend willingness to pay as the appropriate economic measure of the benefits of recreation (Walsh 1986:45). (see also: Comprehensive Income, Consumer Surplus, Household Production, Recreation Benefit Valuation)