CWT 10-4

Report on POLLUTION OF THE INTERSTATE WATERS of LAKE CHAMPLAIN AND ITS TRIBUTARIES

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
NORTHEAST REGION
WATER QUALITY MANAGEMENT CENTER
Edison, New Jersey 08817

November 1968

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"Lake Champlain is, as you are aware, an interstate body of water and its resources are of great importance to the States of Vermont and New York. In order that these resources may be conserved it is necessary that the purity of its waters be maintained. Therefore a determination of the present condition of the lake, the effect of the wastes which are being poured into it, and the conditions which are likely to arise in the future if present practices with reference to waste disposal are continued is highly desirable."

Excerpt from a letter dated March 31, 1904, to the Director of the United States Geological Survey from the Honorable John G. McCollough, Governor of the State of Vermont, requesting an examination of the water of Lake Champlain.

INTRODUCTION

On the basis of a written request from the Commissioner of the Vermont Department of Water Resources, and on the basis of reports, surveys, or studies, in accordance with Section 10 of the Federal Water Pollution Control Act (33 U.S.C. 466 et seq.), the Secretary of the Interior called a conference in the matter of pollution of the interstate waters of Lake Champlain and its tributary basin (New York-Vermont).

This report is based on recent studies conducted by the Department of the Interior, Federal Water Pollution Control Administration in addition to data obtained from other Federal, State and local agencies.

We gratefully acknowledge the cooperation of the Vermont Department of Water Resources, the New York State Health Department and the Lake Champlain Study Center of the University of Vermont.

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SUMMARY AND CONCLUSIONS

1. The waters of Lake Champlain, from the Champlain Canal in the south to the Canadian Border to the north, and that portion of its tributary basin which affects the Lake, receive the discharge of treated and untreated wastes from industries, municipalities, a Federal installation, individual septic tanks and cesspools, recreational and commercial boating, and agricultural and land drainage.

2. As a result of these discharges the interstate waters of Lake Champlain and its tributaries are polluted by the presence of bacteria, solids, oxygen demanding material and nutrients. In addition, some of these waters are affected by the accumulation of bottom sludge deposits and floating sludge masses. This pollution limits the use of these waters for such activities as recreational bathing, boating and general aesthetic enjoyment. Bacterial contamination, in particular, presents a health hazard to persons using these waters.

3. Pollution of interstate waters subject to abatement under Section 10 of the Federal Water Pollution Control Act, as amended, occurs in Lake Champlain: (1) in the vicinity of Ticonderoga Creek, as the result of the discharge of untreated waste from the Village of Ticonderoga and from the International Paper Company plant; and (2) near Whitehall, as the result of the discharge of raw sewage from the Village of Whitehall.

4. As the result of discharge of untreated industrial waste, several areas of Lake Champlain contain extensive sludge deposits. The major deposits center near the mouth of Ticonderoga Creek, and are due mainly to the discharge of untreated paper mill wastes from the International Paper Company.

5. Both New York and Vermont have adopted water quality standards for Lake Champlain which have been approved by the Secretary of the Interior. Under these standards, orders have been issued or voluntary construction schedules established by the respective States for the abatement of all major waste sources, including those sources listed in Item 3 above. These schedules call for construction of remedial facilities by 1970, with the following exceptions:

Port Henry, N. Y.	April 1972
Willsboro, N. Y.	April 1972
Rouses Point, N. Y.	April 1972
Swanton, Vt.	January 1972
Alburg, Vt.	June 1971
Missisquoi Specialty Board, Sheldon Springs, Vt.	December 1972

RECOMMENDATIONS

1. Water quality standards and criteria for both New York and Vermont shall be compatible. Existing standards shall be adjusted to permit use of these waters for water supply with adequate treatment, water contact recreation, and propagation of fish and wildlife. Water quality at the State line shall meet the following requirements:

a. Dissolved Oxygen - not less than 5.0 mg/l at any time.

b. Temperature - The temperature of the epilimnion shall not be raised more than 3°F. above that which existed before the addition of heat of artificial origin. The increase shall be based on the monthly average of the maximum daily temperature. No discharges are to be permitted in the hypolimnion.

c. Bacteria - Fecal coliform shall be used as the indicator organism for evaluating the microbiological suitability of recreational waters. As determined by multiple-tube fermentation or membrane filter procedures and based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content of primary contact recreation waters shall not exceed a log mean of 200/100 ml, nor shall more than 10 percent of total samples during any 30-day period exceed 400/100 ml.

2. All waste treatment facilities shall remove not less than 85 percent BOD at all times. Adequate disinfection shall be provided as necessary to comply with the water uses established by the State, interstate and Federal water quality standards.

3. Studies shall be carried out and completed by September 1, 1969 to determine the extent of sludge deposits, the need for removal, and if the sludge deposits are to be removed, the ultimate disposition of the sludge and the estimated cost of removal.

4. Schedules for construction of remedial facilities, established by the States under the water quality standards and approved by the Secretary of the Interior, shall be maintained (See Par 5, Summary and Conclusions).

I - BASIN CHARACTERISTICS

Description of Area

This report is concerned primarily with the waters of Lake Champlain. The Lake Champlain drainage basin is bounded on the north by the Canadian Border, on the east by Lake Memphremagog and the Connecticut River basin, on the south by the Hudson River basin, and on the west by the St. Lawrence River basin. The maximum length of the Basin is 115 miles from the summit of the Champlain Canal at lock #9 near Fort Edward, New York, north to the Canadian Border. At its greatest width, the Basin reaches 105 miles from the Saranac Lakes in the west to the Winooski River headwaters in the east. From South Bay to the Canadian Border, the boundary line between the States of New York and Vermont lies within Lake Champlain. (See Figure I-1).

Climate

The area around Lake Champlain has long, cold, and snowy winters, relatively short, moderate to hot summers, and transitional seasons of highly variable weather. The average annual air temperature is about 45 degrees Fahrenheit. Temperatures range from below zero in the winter to above 90 in the summer. The annual average precipitation is approximately 37 inches with a maximum of 46 inches and a minimum of 27 inches for the 25 years of record. Generally the precipitation is evenly distributed throughout the year.

Topography

Lake Champlain and its surrounding lowlands are in the Champlain section of the St. Lawrence Valley Physiographic Province, which is a part of the Appalachian Highlands. Lake Champlain is in the northern part of the great trough which extends from New York Harbor to the St. Lawrence River. With the Adirondack Mountains to the west and the Green Mountains to the east, it lies in a low valley which is narrow in the south and gradually widens to approximately 25 miles near the Canadian Border. The surrounding lowlands are characterized by sparse hills and low mountains. Adjacent to the eastern and northwestern shores the land is relatively flat. In the southern part, the western shore is flanked by the rugged Adirondack Mountains, some of which rise out of Lake Champlain.

Geology

The predominant geological features in the immediate vicinity of Lake Champlain are the eastern Adirondack Mountains of New York, and the Champlain Valley of New York and Vermont. Most of the eastern Adirondacks is underlain by metamorphic and igneous rocks of pre-Cambrian age. The northern end of the pre-Cambrian metamorphic core of the Green Mountains crops out near Middlebury, Vermont. The rest of the Basin is underlain by sedimentary and metamorphic rocks of Cambrian and Ordovician age.

The bedrock of the eastern Adirondacks consists mainly of gneisses, feldspars, quartzites, hornblend and crystalline limestone. Commercial deposits of non-titaniferous magnetite, feldspar, wallastonite-garnet, quartz and graphite are present.

The bedrock of the Champlain Valley consists principally of limestone, dolomite, shale and sandstone. In Clinton County, New York, the bedrock is mostly Potsdam Sandstone which has been quarried for building and curb stones. The Chazy and Blackmantown limestones are quarried and used for crushed stone and in the manufacture of lime.

In the Vermont section of the Valley, the limestone, dolomites, shale and sandstones are metamorphosed. Marble quarries are located at Proctor and West Rutland. South of Burlington, limestone is quarried and crushed.

Most of the bedrock is covered by unconsolidated surficial materials consisting of glacial till, aqueo-glacial deposits and alluvium. Glacial till covers much of the upland areas and valley walls. Most major stream valleys have aqueoglacial deposits, which are a source of commercial sand and gravel. Along Lake Champlain and in a few stream valleys are found deposits of glacial lake clay.

Hydrology

The drainage area of the Lake Champlain basin in the United States is approximately 7,700 square miles. Selected hydrologic characteristics for those tributary streams having a drainage area in excess of 250 square miles are shown below.

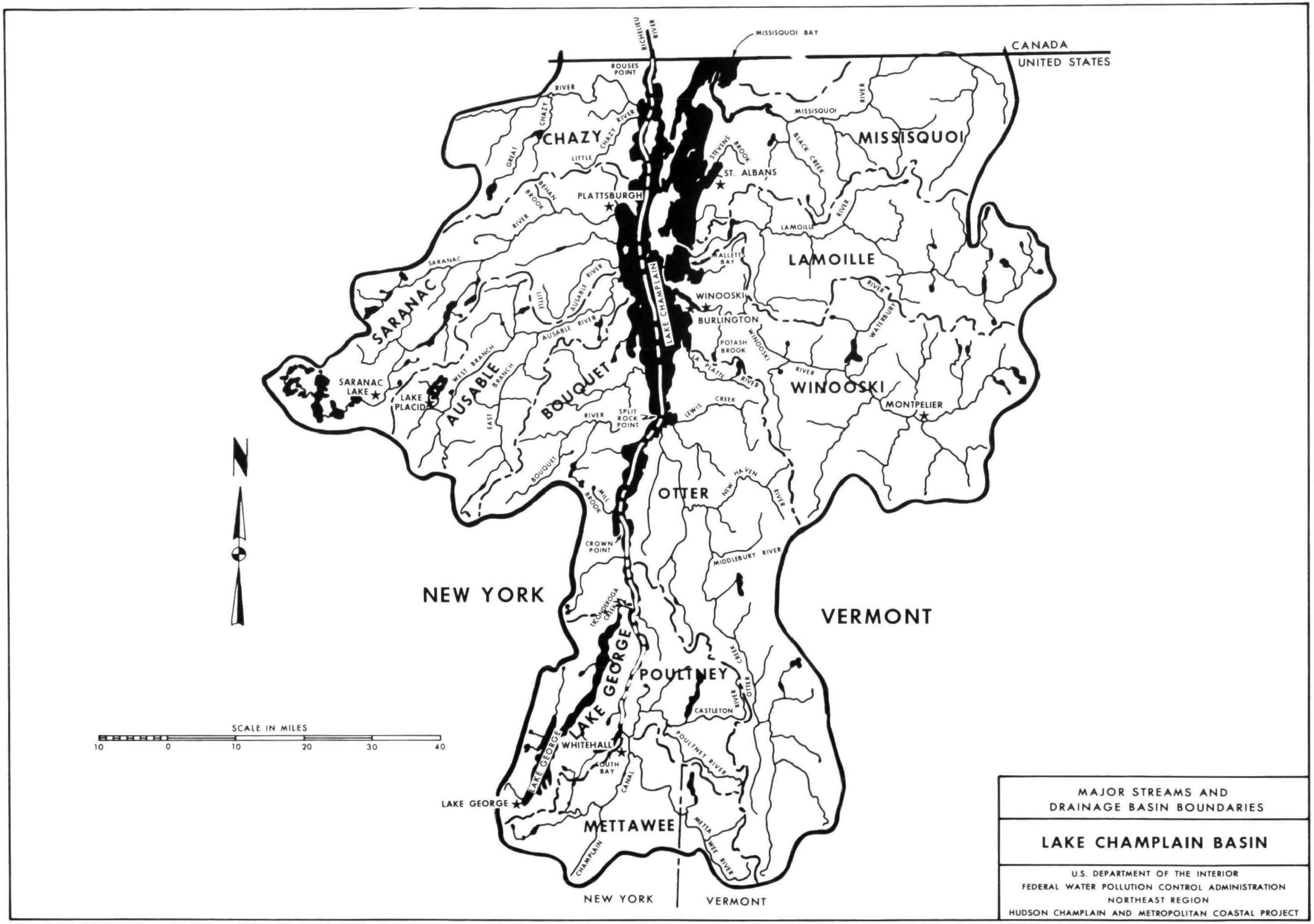
Stream	Drainage Area in U.S. (sq. mi.)	Average Annual Flow (cfsm)*	Minimum Daily Flow 1964 WY (cfsm)*	Years of Record	Waterway Length (mi.)
Poultney River	261	2.6	.02	36	39
Otter Creek	941	1.5	.18	48	105
Winooski River	1,065	1.6	.04	36	90
Lamoille River	716	1.8	.11	35	84
Missisquoi River	867	1.9	.13	48	88
Great Chazy River	300	1.1	.06	36	47
Saranac River	614	1.4	.15	48	60
Ausable River	518	1.5	.25	54	55
Bouquet River	278	1.0	.12	41	49
Lake George	262	1.3	.05	22	45

*cfsm - cubic feet per second per square mile

On the basis of the average annual flows in streams tributary to Lake Champlain, the average runoff in the Basin is about 22 inches per year or a little more than 60 percent of the precipitation. Lake Champlain discharges into the Richelieu River which flows northward into the St. Lawrence River.

Hydrography

Lake Champlain is long and narrow, having a length of 107 miles and a maximum width of about 12 miles. The surface area of the Lake and its contained islands is 473 square miles. The longitudinal axis of the Lake is generally in



MAJOR STREAMS AND
DRAINAGE BASIN BOUNDARIES
LAKE CHAMPLAIN BASIN
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
NORTHEAST REGION
HUDSON CHAMPLAIN AND METROPOLITAN COASTAL PROJECT
CANADA
UNITED STATES
NEW YORK
VERMONT
SCALE IN MILES
10 0 10 20 30 40
N
RICHELIEU RIVER
MISSISQUOI BAY
ROUSES POINT
CHAZY
GREAT CHAZY RIVER
LITTLE CHAZY RIVER
MISSISQUOI
MISSISQUOI RIVER
BLACK CREEK
STEVENS BROOK
ST. ALBANS
PLATTSBURGH
BEHAN BROOK
SARANAC RIVER
SARANAC
LAMOILLE RIVER
LAMOILLE
MALLETTS BAY
LAKE CHAMPLAIN
LITTLE AUSABLE RIVER
AUSABLE RIVER
WEST BRANCH
EAST BRANCH
AUSABLE
WINOOSKI
BURLINGTON
POTASH BROOK
WINOOSKI RIVER
WATERBURY RIVER
LA PLATTE RIVER
SARANAC LAKE
LAKE PLACID
BOUQUET
BOUQUET RIVER
SPLIT ROCK POINT
LEWIS CREEK
MONTPELIER
MILL BROOK
OTTER
NEW HAVEN RIVER
CROWN POINT
MIDDLEBURY RIVER
TICONDEROGA CREEK
LAKE GEORGE
POULTNEY
OTTER CREEK
CASTLETON RIVER
WHITEHALL
SOUTH BAY
POULTNEY RIVER
CANAL
METTAWEE
METTAWEE RIVER
CHAMPLAIN

Figure I-1

a north to south direction. The Lake can be classified into three major water bodies: (a) the South Lake; (b) the Main Lake; and (c) the Northeast Arm.

The South Lake is that portion of Lake Champlain from the southern end of South Bay to Crown Point. It comprises approximately five percent of the surface area and 0.5 percent of the volume. This extremely narrow portion of the Lake is shallow, with depths generally less than 25 feet.

The Main Lake extends from Crown Point to the Richelieu River in Canada. It is bounded on the west by the mainland of New York State and on the east by the mainland of Vermont and the west shore of a string of islands extending north from Malletts Bay. This section comprises approximately 60 percent of the surface area and 82 percent of the volume of Lake Champlain. It ranges in depth from 20 feet in the extreme northern and southern ends, to greater than 350 feet in the south central portion near Split Rock Point.

The Northeast Arm lies east of the string of islands that divide the Lake north of Malletts Bay. It consists of three bodies of water; Malletts Bay, Missisquoi Bay and the large open waters between, all of which are virtually separated from the Main Lake. These bodies comprise approximately 35 percent of the surface area and 17 percent of the volume of Lake Champlain. Depths range from less than 20 feet in the north to more than 100 feet in the central portion and in Malletts Bay.

The levels of Lake Champlain are prescribed by order of the International Joint Commission which was originally established by the Boundary Waters Treaty of 1909 between the United States and Great Britain. These levels are maintained at a maximum of 95.5 feet and a minimum of 93.0 feet during the navigational season, April through December, and 92.5 feet for the rest of the year. Lake levels are measured at Rouses Point, New York, and refer to mean sea level and a 1929 datum.

Economy

Although Lake Champlain has approximately 500 miles of shoreline, only five widely separated communities with populations greater than 1,000 have developed on the Lake. Burlington, Vermont, with a population of 33,155 and Plattsburgh, New York, with a population of 20,172 are considered the only major urban centers. These cities serve as focal points for much of the commercial, industrial, and cultural activity throughout the drainage basin. An additional 30 communities in the population range 1,000 to 20,000 are dispersed throughout the Basin with the majority located in Vermont. However, since more than one-half of the Basin's inhabitants reside in rural and non-farm areas of less than 1,000 population, the Basin is characterized as primarily rural. Figure I-2 shows the political boundaries and location of selected cities in the Lake Champlain basin.

Based on the most recent government population estimates, the total number of inhabitants in the Lake Champlain drainage basin was 406,300 in 1966 (see Table I-1). This represents an increase of 23,000 or six percent since the last decennial census in 1960. The Basin's most heavily industrialized counties, Chittenden, Vermont (urban center, Burlington) and Clinton, New York (urban center, Plattsburgh) accounted for somewhat more than 70 percent of the population rise recorded for the entire drainage basin. These demographic changes within the Basin point up the increased demand for factory, service, and other technical and professional employment categories which are largely oriented around urban centers.

Population projections, prepared by the New York State Office of Planning Coordination and the Vermont State Planning Office, anticipate that the New York and Vermont sections of the Basin will realize moderately accelerating growth through the eighties and nineties. Based on present population trends, the New York portion of the Basin is expected to reach 191,000 by 1990, an increase of 30 percent over the 1960 level. The Vermont portion of the Basin, which is developing at a markedly faster pace, is expected to reach 346,000 by 1990, an increase of 46 percent over the 1960 level. It is anticipated that population growth in the Basin will take place primarily in and around the urban centers of Burlington, Vermont, and Plattsburgh, New York.

The economy of the Basin has developed substantially because of its natural resources. These resources have been a major factor in supporting the paper, woodworking and mining industries located in the Basin. State and Federal tourist data indicate that there is an accelerating demand for participation in the Basin's aesthetic environment through travel and recreational activities.

An analysis of the employment patterns in the Basin, as shown in Table I-2, shows a relatively well diversified economic mix of manufacturing, trade and service activities. Together, these employment sources account for more than four-fifths of the Basin's covered labor force. In the three year period 1964 to 1967, employment in manufacturing advanced one-third to a record level of 36,000. Nearly all of this growth took place in Vermont. The New York section of the Basin accounts for only 30 percent of all factory workers. Table I-3 contains further data relative to the number of plants and employment for selected industries.

Service industries are third among the fastest growing of the Basin's major economic sectors. About half of the 22,000 people in this expanding sector are involved in activities catering to tourism and recreation through employment in hotels and lodging facilities, amusement and recreation centers. Employment gains at amusement and recreation facilities in Vermont and the results of a special study of recreation in the State illustrate that an accelerating demand for participation in outdoor activities is underway in that section of the Basin. The private and State expansion of recreation and tourist facilities which has been taking place in the New York section of the Basin indicates that a similar trend may be underway there as well.

TABLE I-1

POPULATION GROWTH AND PROJECTIONS, 1960-1990
LAKE CHAMPLAIN DRAINAGE BASIN

STATE AND COUNTY (Percent Within Lake Basin)	1960 Population	1966 Population	Percent Change 1960-1966	1980 Population	Percent Change 1960-1980	1990 Population	Percent Change 1960-1990
NEW YORK STATE (0.9)							
Clinton - (96.7)	70,336	75,426	7.2	91,500	30.1	103,800	47.5
Essex - (90.4)	31,911	31,730	- 0.6	33,500	5.0	35,000	9.7
Franklin - (14.8)	6,601	6,542	- 0.9	6,800	3.0	7,500	13.6
Warren - (13.4)	5,913	6,325	7.0	7,300	23.5	8,200	38.7
Washington - (66.0)	32,000	32,670	2.1	32,700	2.2	36,000	12.5
NEW YORK STATE SUB-TOTAL	146,761	152,693	4.0	171,800	17.1	190,500	29.8
VERMONT STATE (60.7)							
Addison - (98.8)	19,828	20,847	5.1	23,700	19.5	26,700	34.6
Bennington - (3.5)	870	970	11.4	1,100	26.4	1,300	49.4
Caledonia - (12.3)	2,807	2,645	- 5.8	3,300	17.6	3,700	31.8
Chittenden - (100.0)	74,425	85,700	15.1	104,000	39.7	123,000	65.2
Franklin - (100.0)	29,474	28,200	- 4.3	36,000	22.1	41,000	39.1
Grand Isle - (100.0)	2,927	3,200	9.3	3,500	19.6	4,000	36.7
La Moille - (100.0)	11,027	12,100	9.7	13,000	17.9	14,000	27.0
Orange - (12.2)	1,955	2,086	6.7	2,200	12.5	2,400	22.8
Orleans - (22.2)	4,474	4,285	- 4.2	5,300	18.5	6,000	34.1
Rutland - (100.0)	45,890	48,800	6.3	58,000	26.4	67,000	46.0
Washington - (99.9)	42,824	44,755	4.5	50,900	18.9	56,900	32.9
VERMONT STATE SUB-TOTAL	236,501	253,588	7.2	301,000	27.3	346,000	46.3
BASIN TOTAL	383,262	406,281	6.0	471,800	23.1	536,500	40.0

Sources: Population figures for 1960 and 1966: U. S. Bureau of Census, 1960; Current Population Reports, Estimates of the Population of Counties 1966, Series P-25, No. 401; New York State Statistical Yearbook, 1967, New York State Office of Statistical Coordination, 1968; Population Projections for 1980 and 1990: Demographic Projections for New York State Counties, New York State Office of Planning Coordination, 1968; Vermont Population Projections, Vermont Central Planning Office, 1968.

TABLE I-2

DISTRIBUTION OF EMPLOYMENT BY MAJOR ECONOMIC SECTOR, 1967
LAKE CHAMPLAIN DRAINAGE BASIN

Counties in the Lake Champlain Drainage Basin 1/	Employment All Sectors	Agriculture, Forests, Fisheries	Mining	Contract Construction	Manufacturing	Transportation Activities	Retail-Wholesale Trade	Finance, Insurance, Real Estate	Service Activities	Unclassified
NEW YORK										
Percent Employed by Sectors	100.0	0.3	3.5	5.2	35.4	5.2	27.5	3.2	19.5	0.2
Clinton	10,252	30	252	799	2,345	810	3,347	385	2,234	50
Essex	6,496	13	826	216	1,743	220	1,564	230	1,676	8
Franklin	5,923	22	-	232	1,816	294	1,926	230	1,390	13
Washington	8,678	35	29	374	5,195	291	1,778	168	804	4
SUB-TOTAL, 1967	31,349	100	1,107	1,621	11,099	1,615	8,615	1,013	6,104	75
SUB-TOTAL for 1964	28,167	98	1,119	1,027	10,438	1,590	7,848	982	5,045	20
VERMONT										
Percent Employed by Sectors	100.0	0.2	1.4	4.8	35.9	5.6	23.1	5.1	23.5	0.4
Addison	4,356	19	4	129	2,217	249	641	126	966	5
Chittenden	27,441	75	97	1,450	9,013	1,598	6,475	1,319	7,340	74
Franklin	4,436	6	-	116	1,884	252	1,204	128	832	14
Grand Isle	480	-	-	35	351	3	62	6	23	-
La Moille	2,414	14	44	100	466	117	645	78	933	17
Orleans	3,634	7	175	155	1,470	134	798	78	742	75
Rutland	13,664	31	315	724	5,330	889	3,203	560	2,570	42
Washington	11,941	18	303	601	3,794	583	2,738	1,178	2,663	63
SUB-TOTAL, 1967	68,366	170	938	3,310	24,525	3,825	15,766	3,473	16,069	290
SUB-TOTAL for 1964	51,318	159	742	1,913	16,451	3,461	13,048	3,100	12,269	175
BASIN TOTAL - 1967	99,715	270	2,045	4,931	35,624	5,440	24,381	4,486	22,173	365
BASIN PERCENT OF TOTAL EMPLOYMENT	100.0	0.2	2.1	4.9	35.7	5.5	24.5	4.5	22.2	0.4

1/ Data for four counties, small parts of which fall within the Lake Champlain Drainage Basin, have been omitted because it was estimated that fewer than 15 percent of the inhabitants in each of the counties were in the Lake Champlain Drainage Basin.

Source: U. S. Bureau of the Census, County Business Patterns, 1967. The above data include all wage and salary workers covered by Social Security.

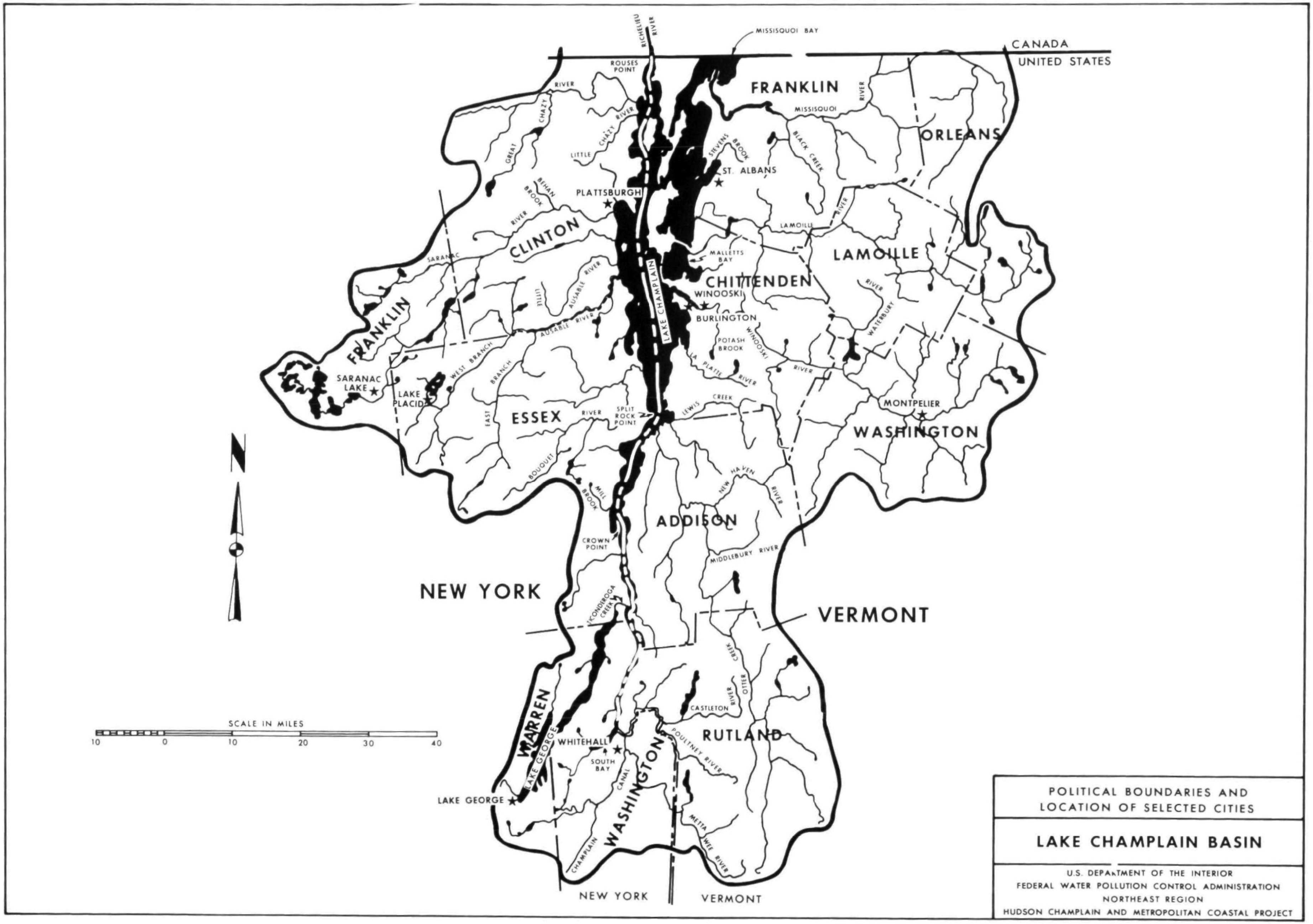
TABLE I-3

DISTRIBUTION OF SELECTED INDUSTRIES,
PLANTS AND EMPLOYMENT, 1967,
LAKE CHAMPLAIN DRAINAGE BASIN

State and County 1/	Total Manufacturing		Food		Textiles		Lumber		Paper		Chemicals		Rubber		Leather		Stone, Clay and Glass		Primary Metals		All Other Manufacturing	
	No. of Plants	No. of Employees	No. of Plants	No. of Emp.	No. of Plants	No. of Emp.	No. of Plants	No. of Emp.	No of Plants	No. of Emp.	No. of Plants	No. of Emp.	No. of Plants	No. of Emp.	No. of Plants	No. of Emp.	No..of Plants	No. of Emp.	No. of Plants	No. of Emp.	No. of Plants	No. of Emp.
NEW YORK																						
Clinton	51	2,345	9	191	-	-			7	1,141	4	719							-	-	31	294
Essex	53	1,743	-	-	-	-	28	271	2	715	-	-							-	-	23	757
Franklin	63	1,816	15	221	-	-	21	438	-	-	-	-			8	699			-	-	19	458
Washington	69	5,195	-	-	-	-	6	101	10	1,207	-	-	1	346			15	209	-	-	37	3,332
SUB-TOTAL	236	11,099	24	412	-	-	55	810	19	3,063	4	719	1	346	8	699	15	209	-	-	110	4,841
VERMONT																						
Addison	39	2,217	-	-	-	-	19	270	-	-	1	155							-	-	19	1,792
Chittenden	98	9,013	23	491	-	-	11	86	-	-	-	-							1	346	63	8,090
Franklin	38	1,884	10	388	-	-	10	58	2	692	-	-							-	-	16	746
Grand Isle	2	351	-	-	-	-			-	-	-	-							1	346	1	5
La Moille	36	466	-	-	-	-	22	344	-	-	-	-							-	-	14	122
Orleans	31	1,470	6	181	-	-	12	240	-	-	-	-							-	-	13	1,049
Rutland	113	5,330	12	138	-	-	28	459	1	346	4	170					21	676	2	165	45	3,376
Washington	137	3,794	13	201	4	193	18	240	-	-	-	-					70	1,550			32	1,610
SUB-TOTAL	494	24,525	64	1,399	4	193	120	1,697	3	1,038	5	325	-	-	-	-	91	2,226	4	857	203	16,790
BASIN TOTAL	730	35,624	88	1,811	4	193	175	2,507	22	4,101	9	1,044	1	346	8	699	106	2,435	4	857	313	21,631
Industry as a percent of total manufacturing	100.0	100.0	12.1	5.1	0.5	0.5	24.0	7.1	3.0	11.5	1.2	2.9	0.2	1.0	1.1	2.0	14.5	16.8	0.5	2.4	42.9	60.7

1/ Data for four counties, small parts of which fall within the Lake Champlain Drainage Basin, have been omitted because it was estimated that fewer than 15 percent of the inhabitants in each of the counties were in the Lake Champlain Drainage Basin.

Source: U. S. Bureau of the Census, County Business Patterns, 1967. The above data include all wage and salary workers covered by Social Security.



CANADA
UNITED STATES
MISSISQUOI BAY
RICHELIEU RIVER
ROUSES POINT
FRANKLIN
ORLEANS
LAMOILLE
CHITTENDEN
CLINTON
FRANKLIN
ESSEX
ADDISON
WASHINGTON
RUTLAND
WARREN
WASHINGTON
NEW YORK
VERMONT
PLATTSBURGH
ST. ALBANS
WINOOSKI
BURLINGTON
MONTPELIER
SARANAC LAKE
LAKE PLACID
SPLIT ROCK POINT
CROWN POINT
WHITEHALL
SOUTH BAY
CASTLETON
LAKE GEORGE
LAKE CHAMPLAIN
LAKE GEORGE
MALLETTS BAY
POTASH BROOK
SCALE IN MILES
10 0 10 20 30 40
NEW YORK
VERMONT
POLITICAL BOUNDARIES AND LOCATION OF SELECTED CITIES
LAKE CHAMPLAIN BASIN
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
NORTHEAST REGION
HUDSON CHAMPLAIN AND METROPOLITAN COASTAL PROJECT

Figure I-2

II - WATER USES

Water Supply

Lake Champlain is used as a source of water supply by 14 municipal systems serving approximately 67,000 people. The information on these facilities is summarized in Table II-1. The average total demand of these systems is 6.9 MGD of which Burlington, serving an estimated 50,000 people, requires 4.3 MGD or nearly two-thirds of the entire municipal withdrawal.

An unknown number of private intakes serve the many summer camps and individual homes or groups of homes located along the Lake shore in both States.

Approximately 20 percent or 1.4 MGD of the output of municipal supply systems goes to industries. Available information indicates the self-supplied industrial demand from the Lake is at least as great as the municipal supply.

Recreation

The open waters and shorelines of Lake Champlain are used extensively for recreational activities, primarily during the summer months. These activities contribute significantly to the tourist trade which is one of the important economic activities in the Basin.

Bathing

Bathing beaches and facilities located along the shores of Lake Champlain reflect the demand for this activity in the Lake. There are either State or municipal beaches at Plattsburgh (Cumberland Bay), St. Albans, Chimney Point, Burlington, Westport, Port Henry and at other places as well as numerous privately owned beaches. The State of Vermont estimated that the demand for bathing in its portion of Lake Champlain was 1,470,000 user-days in 1960, and will grow to 2,450,000 user-days by 1976.

Boating

Lake Champlain is extensively used for pleasure boating. Nearly all of the Lake is navigable and access is facilitated by inland navigable waterways. Many cabin cruisers from Albany, New York City, New Jersey, Long Island, Connecticut, the Great Lakes and Canada visit the area during the boating season. There are 18 marinas with a total of over 900 berths distributed evenly between New York and Vermont. In 1966, approximately 7,800 boats were owned in New York counties adjacent to Lake Champlain. Vermont registered approximately 22,000 boats in 1966, half of which were operated on Lake Champlain. The demand for boating activity, including waterskiing, in the Vermont section of the Lake is expected to increase from about 900,000 user-days in 1960 to nearly 1,400,000 user-days by 1976. Approximately 1,500 recreation-type boats used the Champlain Canal to reach the Lake in 1964 and this traffic is expected to reach 5,100 boats by 1980.

Sport Fishing

Sport fishermen are attracted to Lake Champlain by the presence of a wide variety of sport fish. This is true not only for the summer but also in the winter when ice-fishing is popular. Among the more important food and game species are: northern pike, chain pickerel, walleye, largemouth bass, smallmouth bass, yellow perch and smelt. The State of Vermont estimates the demand for this activity will grow to 1,300,000 user-days by 1976.

Waterfowl

Lake Champlain lies on one of three vital waterfowl migration routes in the mid-section of the Atlantic Flyway. The Lake and its immediate adjoining area provide suitable waterfowl habitat. The important state waterfowl management areas in Vermont are the Dead Creek Refuge, Sandbar Refuge, Mud Creek Refuge, Little Otter Creek Refuge and East Creek Refuge. The Missisquoi National Wildlife Refuge is located in Vermont on the Missisquoi River delta. Important waterfowl areas in New York include Ausable Marsh, Wickham Marsh, Kings Bay, Monty's Bay, Scomotion Creek and Bulwagga Bay.

Navigation

The Champlain Canal is an important segment of the New York State Barge Canal System carrying commercial shipping into Lake Champlain.

In 1965 the freight tonnage was 1.27 million tons as recorded at the summit locks (Champlain Canal) with 1,100 vessel trips. Burlington Harbor with 0.55 million tons is the largest harbor on the Lake, receiving some 270 vessel trips in 1965. Nearly all of the freight traffic is shallow-draft tankers and barges transporting petroleum products.

Interest has been expressed in the development of the Champlain waterway to accommodate larger vessels to enhance commercial navigation between the St. Lawrence Seaway and New York Harbor Complex. A study was made in June 1965 by the International Champlain Waterway Board which included a series of public hearings. It was concluded that further development of the waterway is not feasible and no further action is contemplated.

Table II-1

Lake Champlain

Municipal Water Facilities

Facility or Community	Population Served	Plant Capacity (mgd)	Plant Output (mgd)
New York			
Beekmantown Hobbs Subdivision	100	x	x
Essex Essex Water Co.	100	x	.01
Essex J.R. Morse Water Supply	85	x	.01
Plattsburgh Rocky Point Comm. W.S.	175	x	x
Rouses Point	2,400	x	.50
Willsboro Willsboro Bay	170	x	.02
Willsboro Willsboro WD 2	1,715	.66	.17
Vermont			
Alburg	600	.60	.05
Burlington	50,000	8.00	4.26
Grand Isle Grand Isle Water Co.	90	x	.01
Saint Albans	9,000	3.00	1.50
Shelburne	700	.10	.07
South Hero Source 1 & 2	280	.10	.03
Addison, Stareham, Bridgeport Tri-Town	1,400	x	.25

Source of Data - 1963 Public Health Service Inventory.

III - SOURCES OF POLLUTION

The waters of the Lake Champlain Basin receive the discharge of wastes from municipalities, industries, Federal installations, septic tanks and cesspools, commercial and recreational boating, surface runoff and agricultural land drainage.

Municipal Waste

A total of 29 municipal systems serving approximately 118,000 persons discharge wastes which may have a significant effect on the waters of Lake Champlain. Information on these waste sources, which include 17 discharges in New York and 12 in Vermont, is summarized in Table III-1. Figures III-1 and III-2 show the general location of each waste source reported and are keyed to the Table. Of these sources, nine serving 21,000 persons discharge untreated wastes, 19 serving 88,000 persons provide primary treatment, and one serving 9,000 persons provides secondary treatment. Chlorination of the effluent is known to be provided in 17 plants.

Of these 29 systems, eight, serving about 27,000 persons, discharge treated and untreated wastes directly to Lake Champlain. The Burlington, Vermont, (Main Plant) primary treatment facility is the largest of these systems. Westport, New York, serving 700 persons is the only system discharging untreated waste into the Lake.

The remaining 21 systems, which serve approximately 91,000 persons, discharge into tributary waters. Eleven of these systems are located in New York and ten are in Vermont. Of these 21 systems, there is only one secondary treatment plant. This facility, located at St. Albans, Vermont, serves 9,000 persons. Primary treatment is provided at 12 plants serving 62,000 persons. The facility at Plattsburgh, New York, is the largest of these primary systems. The remaining systems, five of which are in New York and three in Vermont, discharge untreated waste from 20,000 persons. The largest of these systems are Whitehall and Ticonderoga in New York, and Winooski and Colchester Fire District No. 1 in Vermont.

Industrial Waste

Industrial wastes are a major pollution problem in Lake Champlain. The wastes from 18 industrial operations, eight in New York and ten in Vermont, affect the waters of the Lake. Three discharge directly to Lake Champlain and the remainder to tributaries. Table III-2 lists and provides information on these waste sources. Figures III-1 and III-2 show the general location of these waste sources.

The total Biochemical Oxygen Demand (BOD) expressed in population equivalents (PE) which is discharged directly to the Lake from industrial operations in New York is estimated to be 180,000. The Lake is also affected by the additional discharge to tributaries of 385,000 PE. Essentially all of this BOD waste load is from pulp and paper plants, which also contain substantial amounts of fibrous suspended solids, as well as refractory organics where chemical pulping is practiced. In addition, an iron ore processing operation discharges inert suspended solids to a tributary.

There are no significant industrial waste discharges directly into the Lake from Vermont. However, an estimated 45,000 PE, of which approximately 30,000 is from one pulp and paper plant, are discharged into tributaries. In addition, substantial amounts of suspended solids enter the Lake from the Poultney River as the result of waste discharges from a number of slate operations.

Industrial waste discharges significantly affect Lake Champlain at two locations —— the Ticonderoga Creek area and Cumberland Bay near Plattsburgh. International Paper Company, Ticonderoga, New York, carries out Kraft pulping, paper making and bleaching, and discharges waste into Ticonderoga Creek about two miles above its confluence with the Lake. At Plattsburgh, New York, two pulp and paper plants, Georgia Pacific Corporation and Diamond National Corporation, discharge wastes directly to Lake Champlain. The Georgia Pacific operation consists of neutral sulfite semi-chemical pulping and papermaking, and Diamond National has mechanical pulping and papermaking. Imperial Paper Company, with mechanical pulping and papermaking, discharges its waste into the Saranac River about two miles above its confluence with the Lake at Plattsburgh. All of these plants discharge substantial amounts of solids and organic material as shown below:

Waste Source	Flow (MGD)	Suspended Solids (lb/day)	Organic Loading as Population Equivalents (PE)	Receiving Water
International Paper Co. Ticonderoga, N. Y.	15.6	28,400	315,000	Ticonderoga Cr.
Georgia Pacific Corp. Plattsburgh, N. Y.	5.5	8,300	160,000	Lake Champlain
Diamond National Corp. Plattsburgh, N. Y.	1.3	6,600	20,000	Lake Champlain
Imperial Paper Co. Plattsburgh, N. Y.	3.0	18,000	15,000	Saranac River

Federal Installations

There are 30 Federal installations located near Lake Champlain. These installations generate a total volume of approximately 0.8 MGD consisting primarily of domestic waste. Of these 30 installations, 15 discharge to municipal systems, 14 provide treatment with final disposal of the effluent to the ground and one (Plattsburgh Air Force Base) discharges to surface waters.

Plattsburgh Air Force Base, Plattsburgh, New York, discharges 0.02 MGD of treated effluent to the Saranac River. This waste, resulting from aircraft washing operations, is discharged after treatment consisting of floatation, floculation, settling, pH adjustment and skimming (see Table III-2).

TABLE III-1

MUNICIPAL WASTE SOURCES 1/
LAKE CHAMPLAIN DRAINAGE BASIN

Map Ident. No.	Waste Source	Estimated Population Served	Type Collection System	Degree of Treatment	FLOW-MGD Design	FLOW-MGD Actual	Est. BOD Loading Discharged 2/ (PE)	Receiving Water
	NEW YORK							
1	Granville	2,700	S	Primary	35	na	1,760	Mettawee River
2	Whitehall	4,900	C	None	-	na	4,900	Mettawee River
3	Ticonderoga Village	3,000	S	None	-	na	3,000	Ticonderoga Creek
4	Moriah Sewage District #1	270	S	Primary	.1	.03	180	Lake Champlain
5	Moriah Sewage District #2	2,900	S	Primary	.1	.24	2,320	Lake Champlain
6	Port Henry (Village)	1,800	S	Primary	.4	.16	1,170	Lake Champlain
7	Mineville	1,800	S	Primary	.1	na	1,170	Mill Brook Lake Champlain
8	Glover Hill Housing	900	na	Primary	na	na	580	Mill Brook Lake Champlain
9	Westport	700	S	None	-	na	700	Lake Champlain
10	Willsboro	900	na	None	-	na	900	Bouquet River
11	Keesville	300	na	None	-	na	300	Ausable River
12	Peru Sewage District #1	2,800	S	Primary	.3	.18	1,820	Little Ausable River
13	Plattsburgh	27,000	B	Primary	4.0	3.5	17,550	Saranac River
14	Champlain Park S.D.	1,000	S	Primary	.08	.1	700	Lake Champlain
15	Chazy	600	na	None	na	na	600	Little Chazy River
16	Champlain Village	1,550	S	Primary	.25	.43	1,240	Great Chazy River
17	Rouses Point Village	2,160	B	Primary	.65	.3	1,400	Lake Champlain
	VERMONT							
18	Shelburne Fire District #2	500	S	Primary	.1	.09	774 3/	La Platte River
19	South Burlington (Bartlett Rd.) F.D. #4	2,500	S	Primary	.3	.25	2,900 3/	Potash Brook Shelburne Bay
20	Queen City Park	200	na	Primary	-	.2	130	Potash Brook Shelburne Bay
21	Burlington (Main Plant)	18,400	B	Primary	3.7	3.0	27,900 3/	Lake Champlain
22	South Burlington (Main Plant)	5,600	B	Primary	1.2	.314	1,878 3/	Winooski River
23	Burlington (Riverside)	9,000	B	Primary	1.0	.598	5,860 3/	Winooski River
24	Burlington (North End)	7,000	B	Primary	2.0	1.078	8,910 3/	Winooski River
25	Colchester Fire District #1	2,000	S	None	-	na	2,000	Winooski River
26	Winooski	7,000	B	None	-	.45	7,000	Winooski River
27	St. Albans	9,000	B	Secondary	4.0	3.4	4,000	Stevens Brook St. Albans Bay
28	Alburg	300	S	Primary	.015	.03	240	Lake Champlain
29	Swanton	1,500	B	None	na	na	1,500	Missisquoi River

1/ Includes only those waste discharges affecting the Lake.

2/ Where plant data were not available BOD loading discharged in PE were estimated using a percentage removal for each sewage treatment plant. Waste facilities were credited with 35 percent removal for primary treatment, and 85 percent for secondary treatment. The percentage of PE removal was adjusted for those cases where plants were found to be overloaded.

3/ Treatment plant data. Population equivalent discharged include industrial waste loadings.

S - Separate Collection System
C - Combined Collection System
B - Both Separate and Combined Collection Systems
na - Data not available

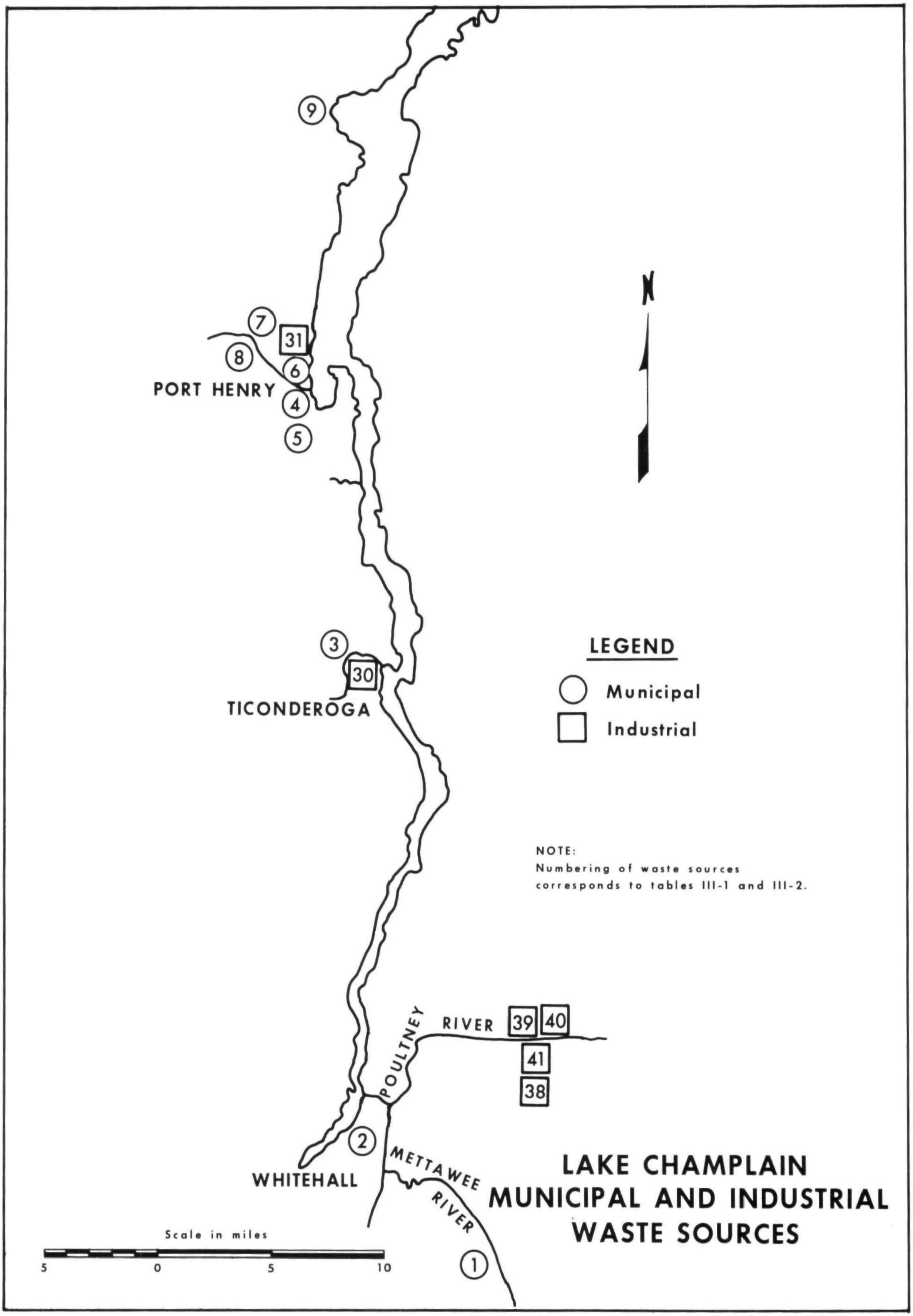
TABLE III-2

INDUSTRIAL WASTE SOURCES
LAKE CHAMPLAIN DRAINAGE BASIN 1/

Map Ident. No.	Industrial Waste Source	Location	Number of Employees	Type of Operation	Est. BOD Loading Discharged (PE) 2/	Treatment	Receiving Water
				NEW YORK			
30	International Paper Co.	Ticonderoga	1150	Pulp and Paper	315,000	Save-all	Ticonderoga Creek
31	Republic Steel Corp.	Port Henry	67	Iron Ore Processing	-	Prim. Clarif. Settling	Bartlett Brook Trib. to Mill Brook
32	Rogers, J & J Co.	Ausable Forks	258	Paper	55,000	Save-all	Ausable River
33	Imperial Paper Co.	Plattsburgh	249	Pulp and Paper	15,000	None	Saranac River
34	Diamond National Corp.	Plattsburgh	327	Pulp and Paper	20,000	Save-all	Lake Champlain
35	Georgia Pacific	Plattsburgh	638	Pulp and Paper	160,000	Save-all	Lake Champlain
36	Plattsburgh Air Force Base	Plattsburgh	-	Aircraft Washing	-	Flotation Flocculation & Settling Skimming	Saranac River
37	Champlain Creameries	Champlain	75	Dairy	1,000	None	Great Chazy River
				VERMONT			
38	Fair Haven Mills	Fair Haven	20-49	Spec. Rayon Fibers Chemicals	3-4,000	None	Castleton River Trib. to Poultney R.
39	Vermont Cut Slate	Fair Haven	4	Slate	-	None	Castleton River Trib. to Poultney R.
40	Vermont Structural Slate	Fair Haven	50	Slate	-	None	Castleton River Trib. to Poultney R.
41	Vermont Structural Slate	Hydeville	5-9	Slate	-	None	Castleton River Trib. to Poultney R.
42	Economu Cheese Co.	Hinesburg	50-99	Dairy	3-5,000	None	La Platte River
43	Louis E. Farrell	Burlington	10-25	Soft Drink	200	None	Lake Champlain
44	John Mc Kenzie Pkg.	Burlington	10	Meat	2,000	Ineffective Septic Tank	Winooski River
45	Milton Co-op Dairy	Milton	50-99	Dairy	1,000	None	La Moille River
46	Missisquoi Specialty Board	Sheldon Springs	270	Pulp and Paper	30,000	Save-all	Missisquoi River
47	Vermont Dressed Beef	Swanton	10-19	Meat	300-1,000	None	Missisquoi River

1/ Includes only those waste discharges affecting the Lake.

2/ Population equivalents determined on a BOD basis using an estimated daily per capita loading of 0.17 pounds of BOD per day.



9
7
31
8
6
PORT HENRY
4
5
N
3
30
TICONDEROGA
LEGEND
Municipal
Industrial
NOTE:
Numbering of waste sources
corresponds to tables III-1 and III-2.
POULTNEY
RIVER
39
40
41
38
2
WHITEHALL
METTAWEE
RIVER
1
Scale in miles
5
0
5
10
LAKE CHAMPLAIN
MUNICIPAL AND INDUSTRIAL
WASTE SOURCES

Figure III-1

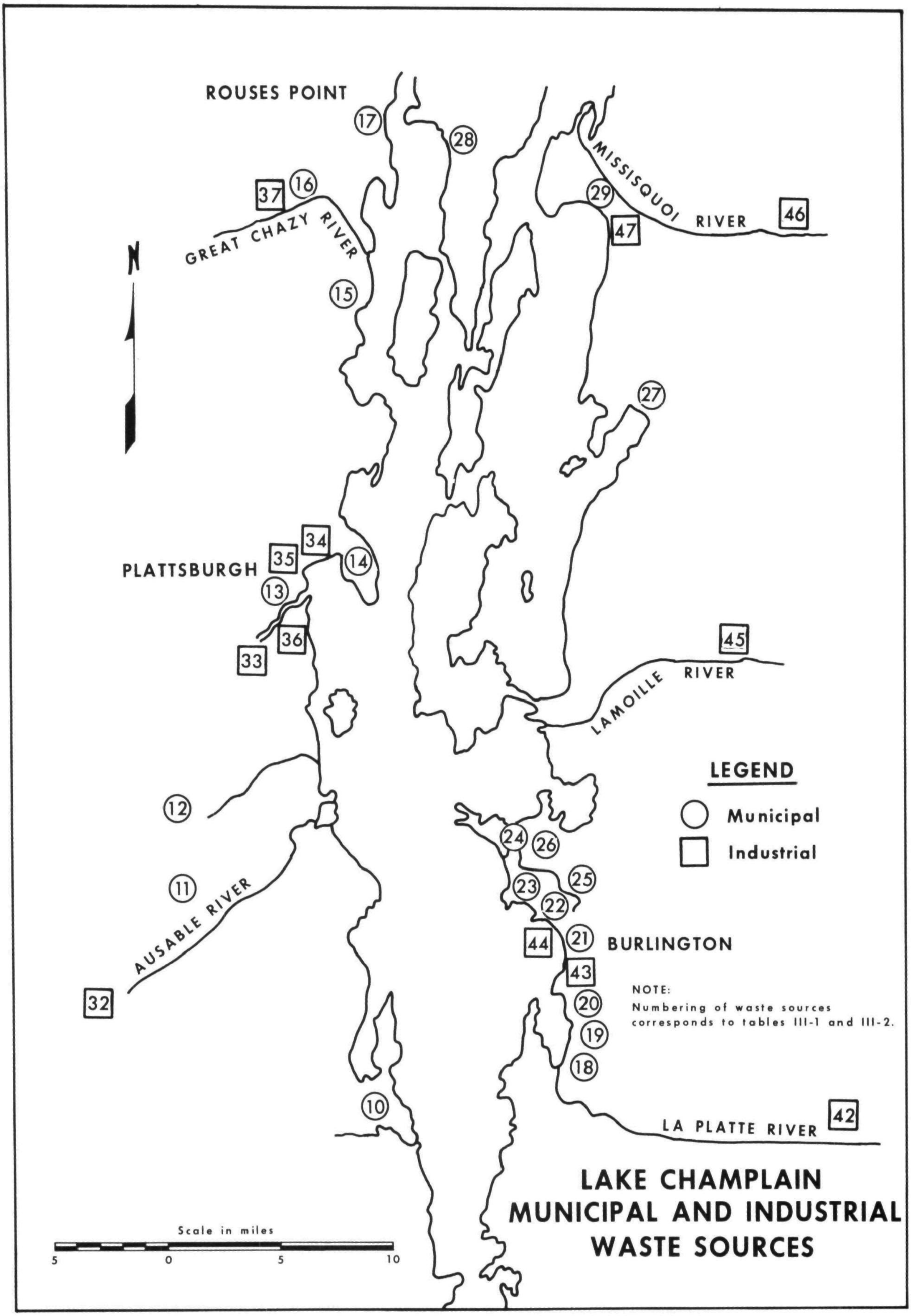

ROUSES POINT
17
28
37
16
GREAT CHAZY RIVER
15
MISSISQUOI RIVER
29
47
46
27
PLATTSBURGH
35
34
14
13
36
33
45
LAMOILLE RIVER
LEGEND
Municipal
Industrial
12
11
AUSABLE RIVER
32
24
26
23
25
22
21
44
BURLINGTON
43
20
19
18
NOTE:
Numbering of waste sources corresponds to tables III-1 and III-2.
10
LA PLATTE RIVER
42
LAKE CHAMPLAIN
MUNICIPAL AND INDUSTRIAL
WASTE SOURCES
Scale in miles
5
0
5
10

Figure III-2

Septic Tanks and Cesspools

Many summer camps and private homes located along the shores of Lake Champlain dispose of domestic sanitary waste by individual septic tanks and cesspools. The direct discharge or leaching of pollutants from these systems, particularly bacteria and nutrients, constitutes a source of pollution of the Lake waters.

Stormwater Overflow

Combined stormwater-sanitary sewage collection exists at ten municipal systems. These systems, three in New York and seven in Vermont, serve approximately 92,000 persons. Of these systems, one in New York (Rouses Point) and one in Vermont (Burlington, Main Plant), discharge directly to Lake Champlain waters. The remainder discharge to tributaries. During storm periods, the overflows from these systems can represent a source of untreated sanitary waste. They may contain large amounts of suspended solids, putrescible organic matter and bacteria.

Recreational Boating

The waters of the Lake Champlain Basin, particularly the Lake itself, are widely used for recreational boating. This activity can represent a source of pollution as the result of the discharge of human fecal matter, litter, motor exhaust and oil. The discharge of untreated fecal matter into the Lake and its tributaries may add pathogenic bacteria which would result in a serious health hazard where the water is used for drinking or recreation. Litter causes a deterioration of the aesthetic quality of the environment, particularly where it gathers along the shore line.

Other Pollutional Problems

Water quality is adversely affected by several other sources of pollution. Lake Champlain is periodically polluted by spills of petroleum products from commercial vessels and shore installations. Fifteen such incidents have occurred since 1965, the largest of which involved about 15,000 gallons of jet fuel.

Erosion by surface runoff transports large amounts of soil and natural organic material into water bodies. This material settles to the bottom, creating deposits such as those found in Lake Champlain. The disturbance of the bottom deposits by commercial navigational watercraft results in the re-suspension of muds and debris. This condition has been observed to be of significance in affecting water quality of the southern portion of Lake Champlain where depths are shallow.

IV - WATER QUALITY

A survey was conducted by the Federal Water Pollution Control Administration during the period of August 19-26, 1968, to determine quality in the waters of Lake Champlain. The details describing the survey and the results are summarized in Appendix C. Data compiled by the States of New York and Vermont and the Lake Champlain Study Center of the University of Vermont were used to supplement FWPCA data.

The data were evaluated in terms of parameters established by the water quality standards for these waters. Specific parameters such as temperature, dissolved oxygen, bacteria, suspended solids, nutrients, color and turbidity, which generally characterize water quality and highlight the effects of pollution, are discussed below.

Although specific data were not collected for the interstate tributary waters of the Missisquoi, Poultney and Mettawee Rivers, available information on municipal and industrial waste sources, as well as State water quality data, indicates pollutional problems exist in these waters.

Temperature

Temperature is an important physical parameter since it affects the solubility of dissolved oxygen, rates of chemical and bio-chemical reactions, bacterial growth rates and the growth of biological flora and fauna. The temperature of a water body will depend upon the climate of the area and the water depth. Deep waters usually show a smaller response to climatic change than shallow waters. Waters of deep lakes become thermally stratified. The colder, denser water remains in the bottom while the warm waters cover the surface. These water layers, called the hypolimnion and the epilimnion respectively, are separated by a thermal transitional zone called the thermocline. Circulation between these zones remains limited until climatic conditions are such that a uniform water temperature profile is again established.

The survey by FWPCA in August 1968 indicates that the southern end of Lake Champlain from South Bay to Crown Point was not stratified and had a uniform temperature. In the main body of the Lake, from Crown Point to Rouses Point, stratification was encountered. The epilimnion ranged in depth from 20 to 60 feet and in temperature from 18 to 20 degrees Centigrade. The thermocline ranged in thickness from 10 to 50 feet and the hypolimnion was found to start from 50 to 100 feet below the surface with temperatures of from seven to 11 degrees Centigrade.

The Northeast Arm of the Lake is also stratified but to a lesser extent than the main body of the Lake. The epilimnion was found to be 50 to 60 feet deep with a temperature between 20 to 22 degrees Centigrade. The hypolimnion begins at 80 to 90 feet from the surface and has a temperature of about 15 degrees Centigrade.

Shallow areas of the main Lake and the Northeast Arm were not found to be stratified.

Dissolved Oxygen

Dissolved oxygen (DO) is one of the most significant parameters of water quality. Adequate levels of DO are necessary to support fish and other forms of aquatic life. Organic pollution results in the utilization of DO in the receiving water during stabilization of the waste material by bacteria. Oxygen is transferred from the atmosphere or from the photosynthetic production by aquatic plants to replace the oxygen used up during the decomposition of the organic matter. Where the oxygen demands of organic pollution remove all of the dissolved oxygen, aneorbic conditions exist and the waters become septic and foul smelling, thus creating obnoxious environmental conditions.

Lake Champlain receives the discharge of organic material from a variety of pollutional sources. The discharge of these waste materials into waters with limited dilution or restricted circulation can result in depressed DO concentrations that are less than required for the beneficial use of the waters. The FWPCA sampling program showed that DO levels ranged from a minimum of 1.4 to a maximum of 10.4 milligrams per liter (mg/l). Saturation values ranged from 16 to 107 percent. Dissolved oxygen levels for both surface and deep waters were generally the same, with most stations showing a variation of less than 10 percent. However, several stations in the Northeast Arm and most of those in the Ticonderoga area showed significantly larger DO variations.

Figure IV-1 presents the DO profile of surface stations (five feet deep) from Whitehall to Rouses Point along the State line. Dissolved oxygen levels in the main Lake (Port Henry to Rouses Point) were found in all cases to be greater than 8.0 mg/l. Levels in the southern portion (Whitehall to Port Henry) were somewhat less, with values in the Ticonderoga area depressed to less than 5.0 mg/l, indicating the effect on the Lake of wastes entering from Ticonderoga Creek.

Figure IV-2 illustrates the DO profiles found in the Ticonderoga area from Chipman Point to Five Mile Point. Dissolved oxygen in this area was critically depressed to values less than four mg/l, with a minimum of 1.4 mg/l at Mount Independence Point. A joint survey conducted by the FWPCA and the States of New York and Vermont in August 1966 showed a similar depressed oxygen condition in the Ticonderoga Creek area. Other studies by the Lake Champlain Study Center at the University of Vermont further confirm the depressed oxygen condition in the Ticonderoga area.

A low DO value of 5.8 mg/l in the main Lake occurred at one station in Cumberland Bay, indicating a localized pollutional condition caused by the municipal and industrial waste discharges in the Plattsburgh area. Two deep stations in the Northeast Arm showed DO values of 5.1 and 5.2 mg/l, with percent saturations of 51 and 52, respectively. Both of these samples were collected from the hypolimnion and suggest the effect of decomposition of accumulated organic matter and restricted circulation due to stratification.

Bacteria

Bacteria from human wastes can constitute a major water pollution problem. These organisms enter the waters of Lake Champlain through the discharge of

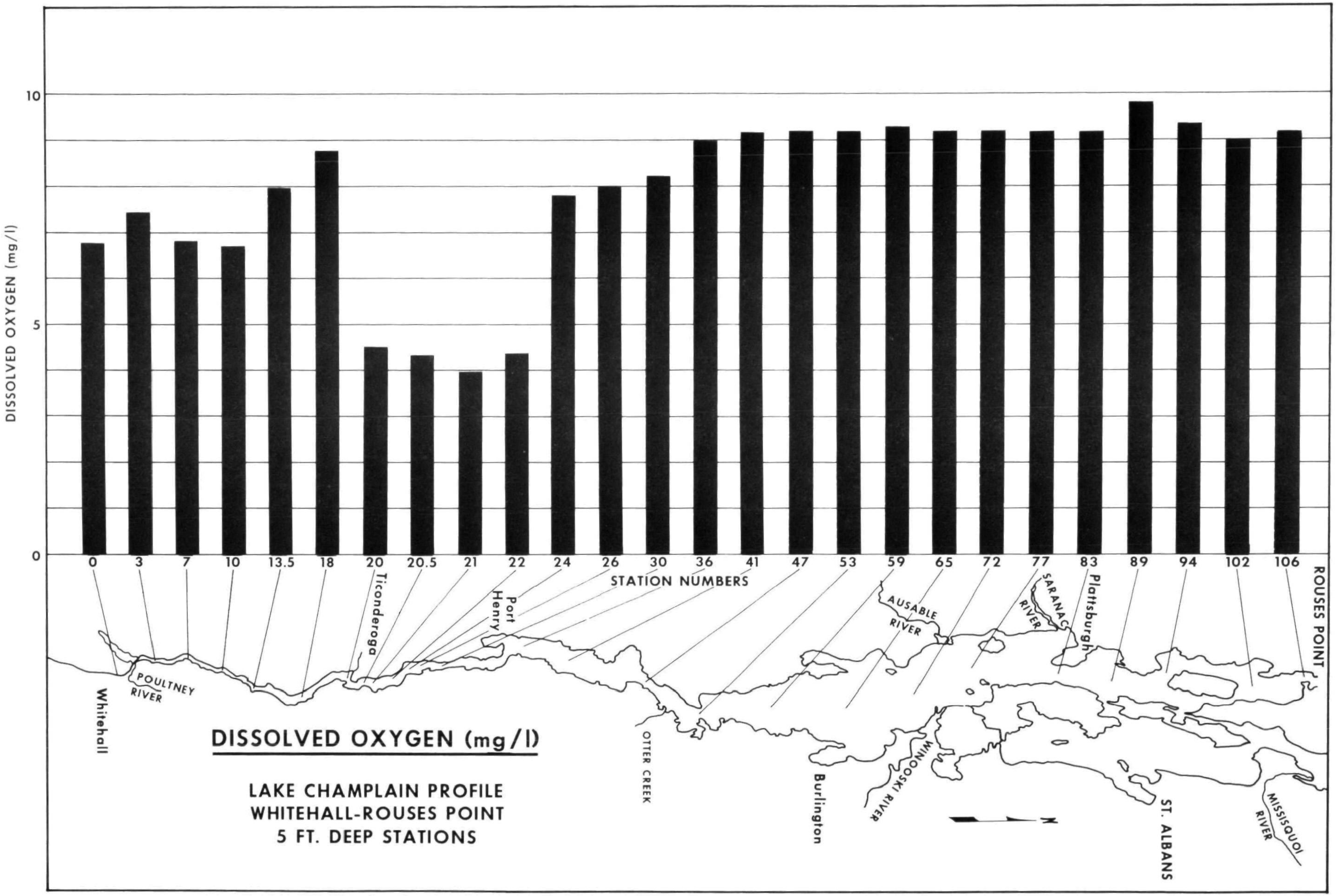

DISSOLVED OXYGEN (mg/l)
10
5
0
0
3
7
10
13.5
18
20
20.5
21
22
24
26
30
36
41
47
53
59
65
72
77
83
89
94
102
106
STATION NUMBERS
Whitehall
POULTNEY RIVER
Ticonderoga
Port Henry
OTTER CREEK
Burlington
WINOOSKI RIVER
AUSABLE RIVER
SARANAC RIVER
Plattsburgh
ST. ALBANS
MISSISQUOI RIVER
ROUSES POINT
N
DISSOLVED OXYGEN (mg/l)
LAKE CHAMPLAIN PROFILE
WHITEHALL-ROUSES POINT
5 FT. DEEP STATIONS

Figure IV-1

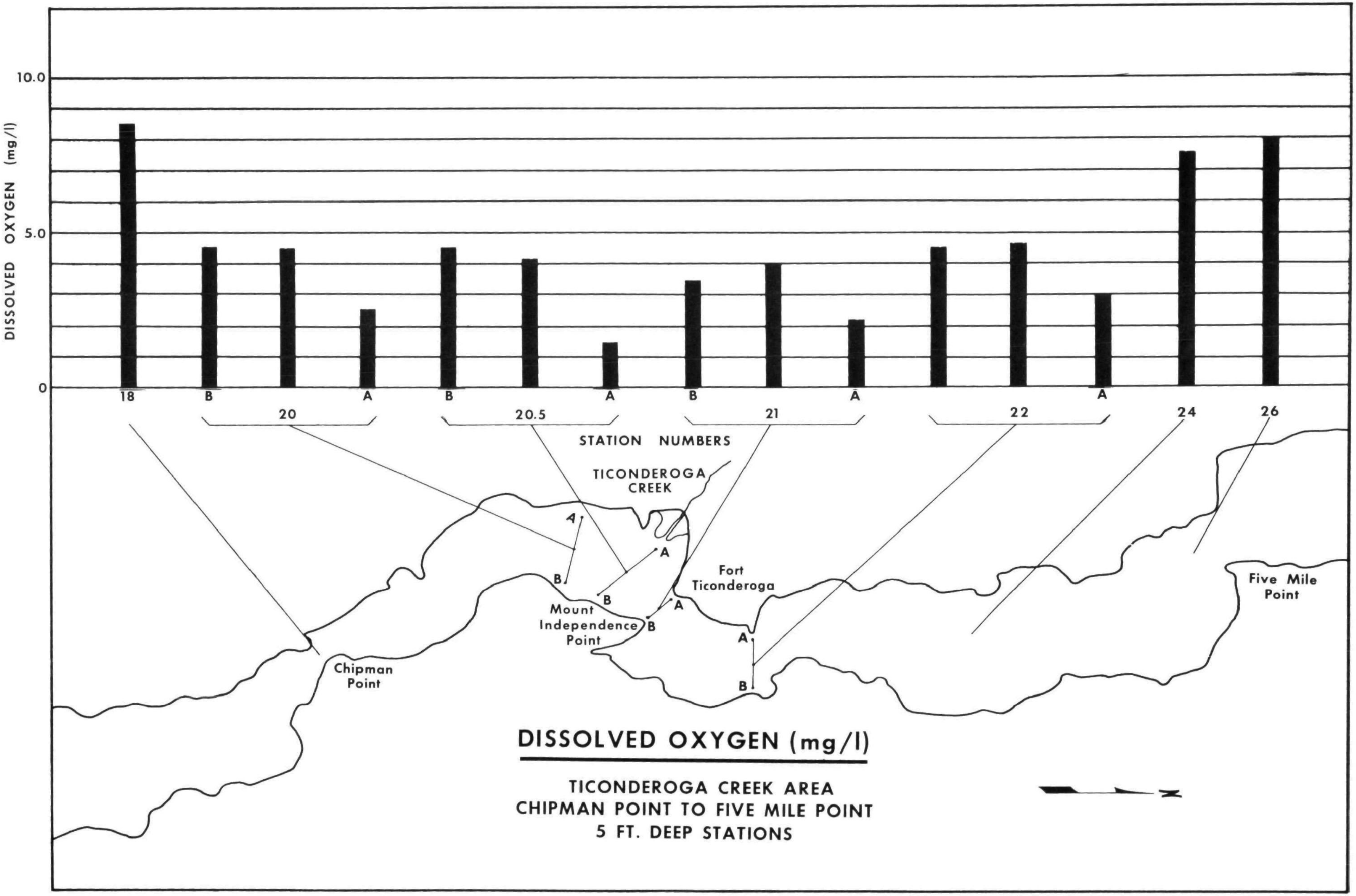

10.0
5.0
0
DISSOLVED OXYGEN (mg/l)
18
B
20
A
B
20.5
A
B
21
A
22
A
24
26
STATION NUMBERS
TICONDEROGA CREEK
Fort Ticonderoga
Mount Independence Point
Chipman Point
Five Mile Point
DISSOLVED OXYGEN (mg/l)
TICONDEROGA CREEK AREA
CHIPMAN POINT TO FIVE MILE POINT
5 FT. DEEP STATIONS

Figure IV-2

inadequately treated wastes.

Coliform organisms are used as an indicator to assess bacterial contamination. They can originate from the wastes of warm-blooded animals and are found naturally in soils. The results of the FWPCA sampling program show that total coliform counts ranged from a maximum of 320,000 per 100 ml near Ticonderoga Creek to as low as 8 per 100 ml in the main Lake. Figure IV-3 presents a profile of total coliform densities from surface stations along the State line. Total coliform values south of Port Henry were generally higher than in the main Lake, supporting the water quality pattern developed by the DO profile discussed previously. Exceptionally high levels were found in the Ticonderoga Creek area where values approached 15,000 per 100 ml. A significantly high count of 28,000 per 100 ml was also found near Whitehall. In contrast, coliform levels in the main Lake were in most cases less than 1,000 per 100 ml. Three counts greater than 1,000 per 100 ml were found in the Lake stretch from near the Otter Creek outlet to the Ausable River outlet.

Total coliform counts throughout the Ticonderoga Creek area are shown in Figure IV-4. All samples in the immediate area of Ticonderoga Creek showed a total coliform level in excess of 5,000 per 100 ml. The maximum count of 320,000 per 100 ml was found near the Creek outlet. Data collected during the 1966 survey also show high coliform counts, further confirming the serious bacterial condition in this area.

At certain other areas, such as Cumberland Bay, Port Henry and Westport in New York, and Shelburne and Burlington Bays in Vermont, elevated total coliform levels were found to occur.

Analyses for fecal coliform concentrations, which represent an indication of recent contamination of the environment with feces of warm-blooded animals, were made at all stations during the August 1968 survey. Figure IV-5 shows a fecal coliform profile for the surface stations taken in Lake Champlain along the State line. Fecal counts in the main Lake were generally less than four per 100 ml, suggesting that the high total coliform levels discussed earlier may be the result of natural surface runoff. Significantly higher counts occurred in the Whitehall and Ticonderoga Creek area where fecal coliform levels reached values of 1,800 and 800 per 100 ml, respectively. As shown in Appendix Table C-1, a maximum value of fecal coliform in the Ticonderoga Creek area reached 11,000 per 100 ml.

There are no criteria established by the applicable water quality standards which provide levels for fecal coliform concentrations. Studies on the Ohio River as reported by the National Technical Advisory Committee to the Secretary of the Interior on Water Quality Criteria, indicate that detectable health effects may occur where the fecal coliform level is about 400 per 100 ml. Based upon this study, pollutional problems resulting from contamination by human or animal excreta appear to exist in the areas of Ticonderoga, Whitehall, and in Cumberland Bay.

Suspended Solids

Suspended solids from industries, municipalities and other sources decrease the aesthetic value of the Lake while in suspension and form objectionable bottom deposits on settling. The sludge blanket formed covers and destroys the natural aquatic life on the bottom. The organic matter in the sludge undergoes decomposition which reduces dissolved oxygen in the overlying waters, at times below that needed for survival by fish and other aquatic life. When depletion of oxygen occurs, the further decomposition of organic matter produces obnoxious gases which appear as bubbles on the surface. These gases frequently break loose masses of the deposited sludge and lift them to the surface where they appear as unsightly clumps.

In Lake Champlain, this problem is most significant in the southern section. Slate and quarrying operations on the Poultney River and its tributaries discharge inorganic suspended solids that are essentially inert. These solids affect the stream and ultimately reach Lake Champlain waters. A large pulp and paper plant on Ticonderoga Creek discharges large amounts of suspended solids which enter the Lake. These suspended solids include a large proportion of decomposable organic matter.

Surveys by the FWPCA in August and September 1968 disclosed extensive sludge deposits in Lake Champlain at the mouth of Ticonderoga Creek and in the northwest corner of Cumberland Bay. The sludge delta at Ticonderoga Creek was extensively sampled and the results are summarized in Figure IV-6. In the immediate vicinity of the mouth of the Creek and near the New York shore southwest of the mouth, grey sludge with a fibrous texture and a hydrogen sulfide odor was found. In places, this sludge measured over 12 feet deep. Gas bubbles and floating solids were prevalent on the surface and several masses of sludge were observed coming to the surface. In the deeper waters between the mouth and the New York-Vermont State line, the bottom was a dark ooze with fewer fibers. In water 10 to 20 feet deep, few fibers were found in the ooze and the hydrogen sulfide odor was slight. This bottom was also characteristic of the area between the mouth and the shore north of the Creek. This type of bottom gradually gave way to a soft clay with a slight hydrogen sulfide odor. At points 400 yards south, 800 yards northeast and 600 yards due east of the mouth of the Creek, the tainted bottom gave way to a sand-clay bottom that had no odor. Despite the clean bottom, floating solids were found along the Vermont shore north of Catfish Bay.

Nutrients

Nutrients stimulate the growth of algae and other aquatic plants resulting in the deterioration of water quality. Although over 20 elements are necessary as nutrients for aquatic plant growth, deficiencies in phosphorus and nitrogen are believed to be the most common restraining factors. Municipal waste is a significant source of phosphorus and nitrogen in these waters. Other sources include agricultural runoff and drainage, discharge from boats, percolation from cesspools and septic tanks, industrial wastes, and waterfowl.

There is considerable evidence that low concentrations of phosphate and nitrogen will support algal growth. Levels of phosphate in the range of 0.01

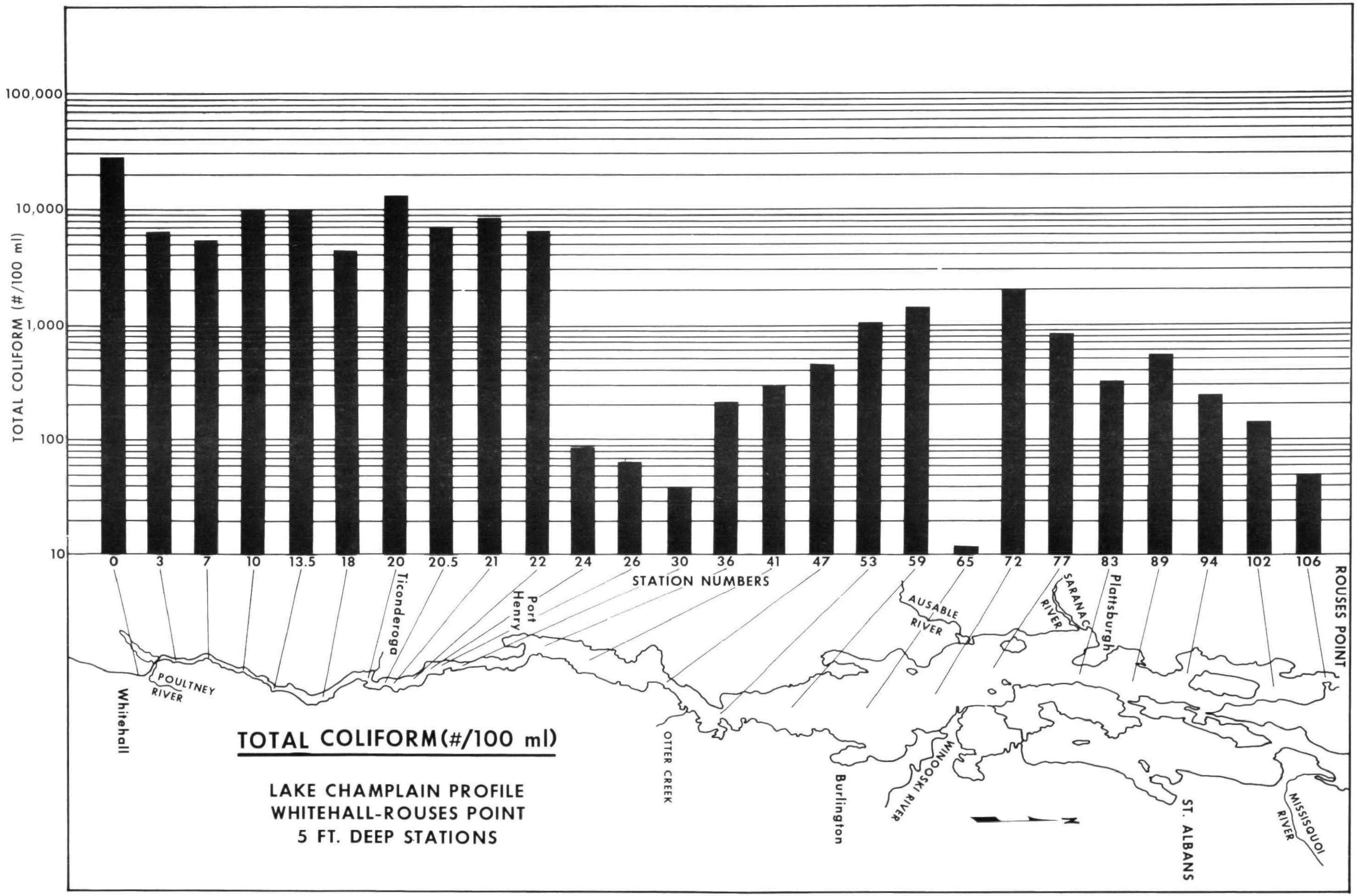
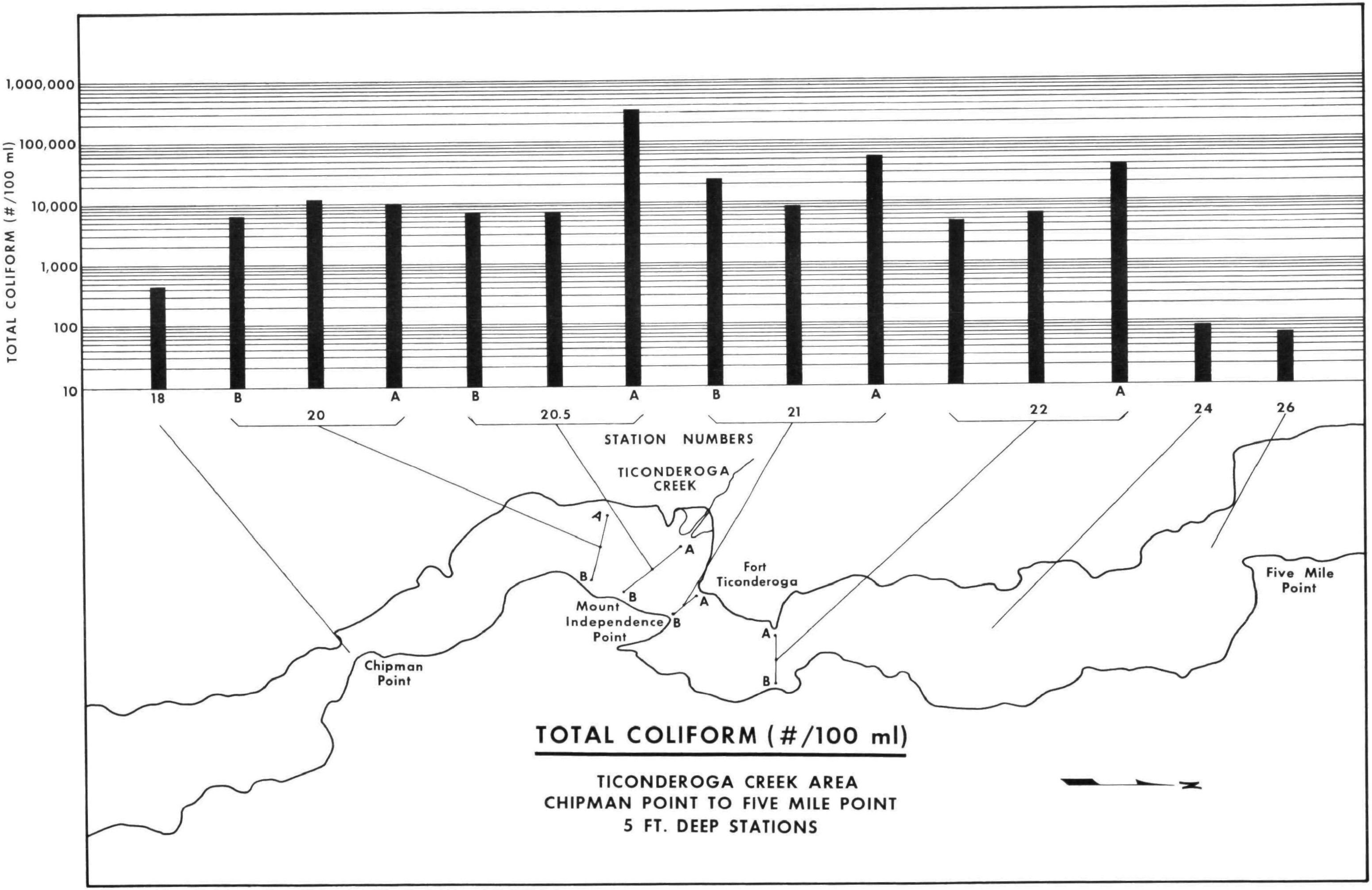

100,000
10,000
1,000
100
10
TOTAL COLIFORM (#/100 ml)
0
3
7
10
13.5
18
20
20.5
21
22
24
26
30
36
41
47
53
59
65
72
77
83
89
94
102
106
STATION NUMBERS
Whitehall
POULTNEY RIVER
Ticonderoga
Port Henry
OTTER CREEK
Burlington
WINOOSKI RIVER
AUSABLE RIVER
SARANAC RIVER
Plattsburgh
ST. ALBANS
MISSISQUOI RIVER
ROUSES POINT
TOTAL COLIFORM(#/100 ml)
LAKE CHAMPLAIN PROFILE
WHITEHALL-ROUSES POINT
5 FT. DEEP STATIONS

Figure IV-3



TOTAL COLIFORM (#/100 ml)

TICONDEROGA CREEK AREA
CHIPMAN POINT TO FIVE MILE POINT
5 FT. DEEP STATIONS

Figure IV-4

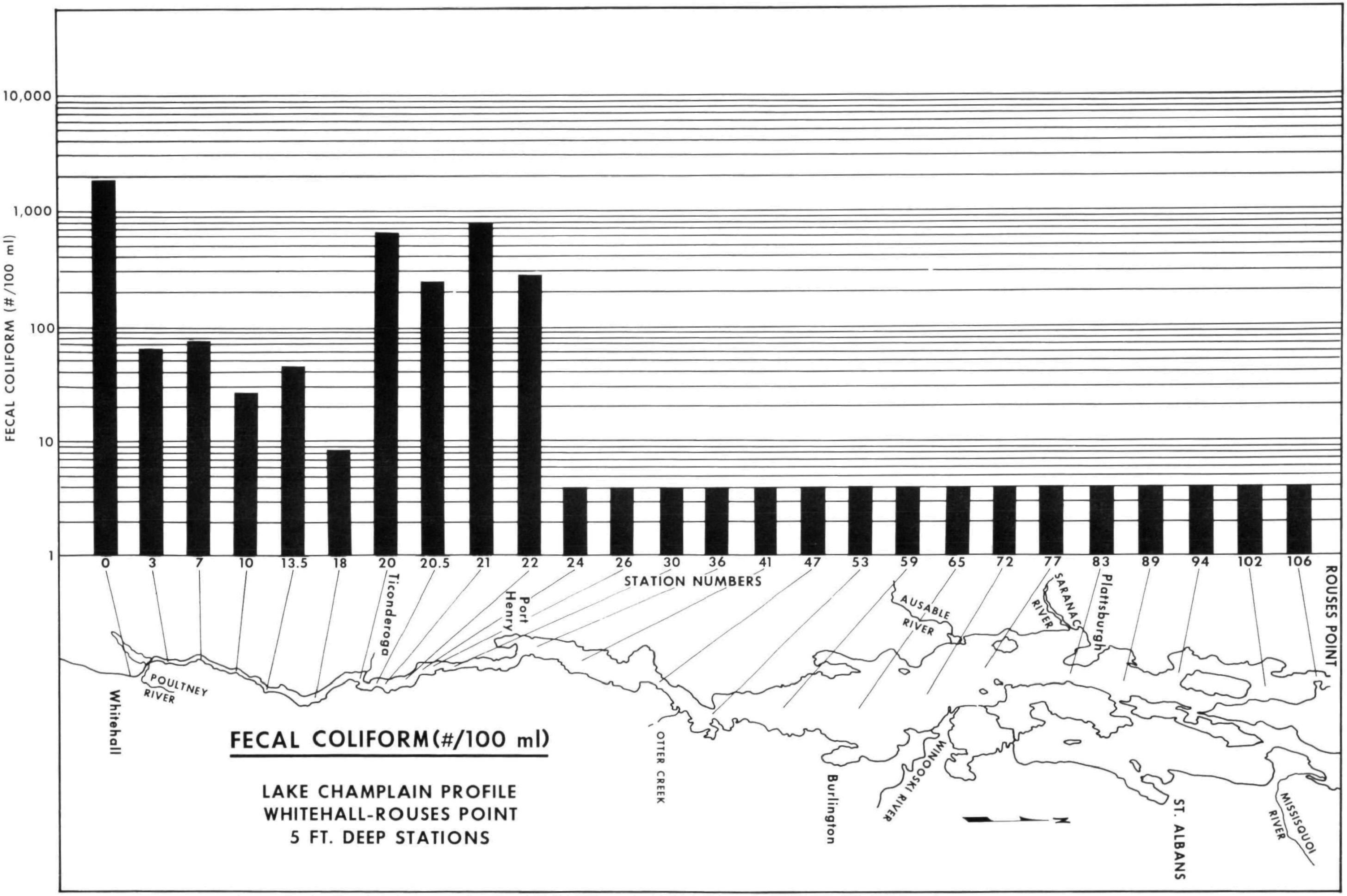
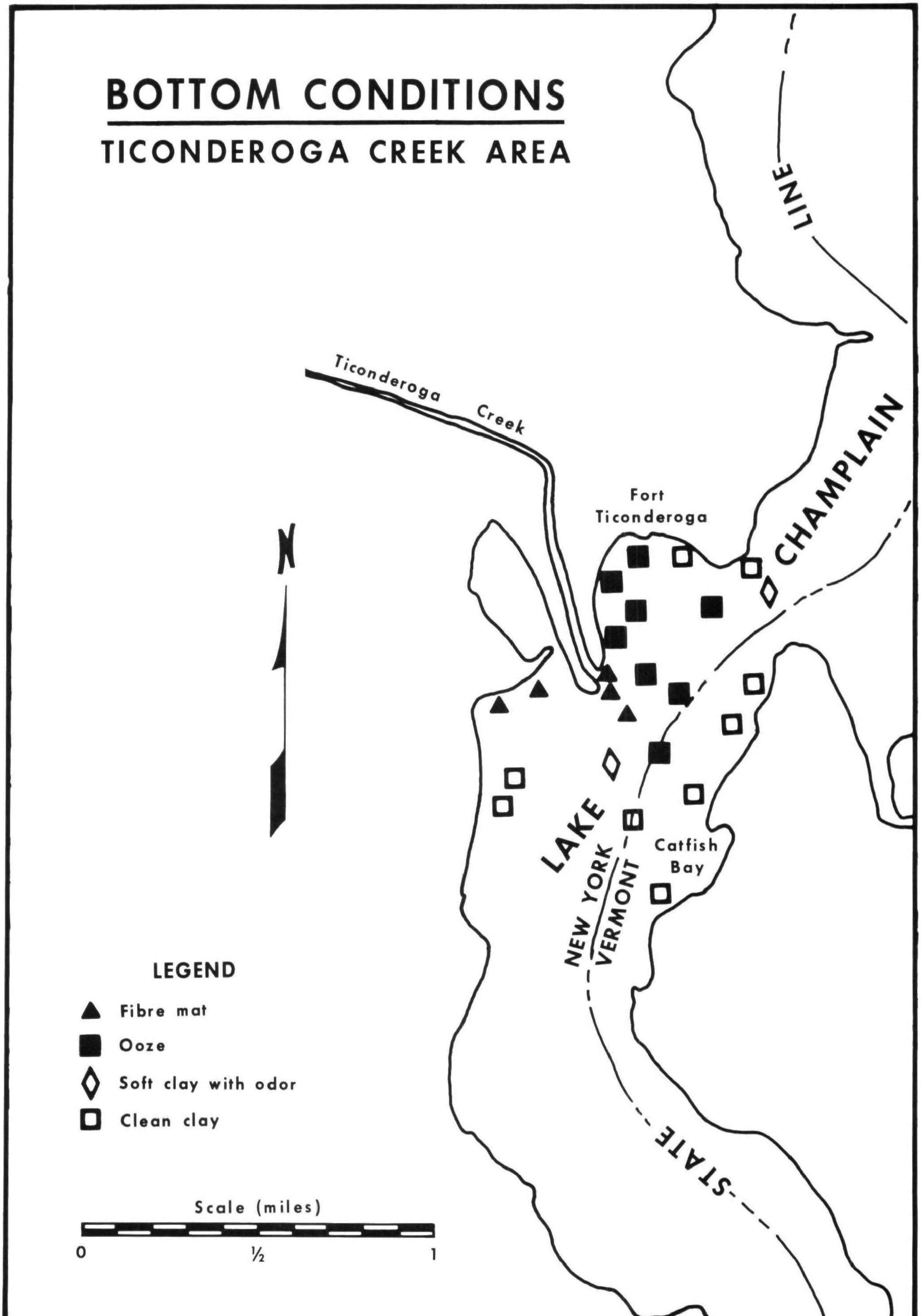

10,000
1,000
100
10
1
FECAL COLIFORM (#/100 ml)
0
3
7
10
13.5
18
20
20.5
21
22
24
26
30
36
41
47
53
59
65
72
77
83
89
94
102
106
STATION NUMBERS
Whitehall
POULTNEY RIVER
Ticonderoga
Port Henry
OTTER CREEK
Burlington
WINOOSKI RIVER
AUSABLE RIVER
SARANAC RIVER
Plattsburgh
ST. ALBANS
MISSISQUOI RIVER
ROUSES POINT
FECAL COLIFORM(#/100 ml)
LAKE CHAMPLAIN PROFILE
WHITEHALL-ROUSES POINT
5 FT. DEEP STATIONS

Figure IV-5



BOTTOM CONDITIONS
TICONDEROGA CREEK AREA
LINE
Ticonderoga
Creek
CHAMPLAIN
Fort
Ticonderoga
N
LAKE
Catfish
Bay
NEW YORK
VERMONT
LEGEND
Fibre mat
Ooze
Soft clay with odor
Clean clay
STATE
Scale (miles)
0
½
1

Figure IV-6

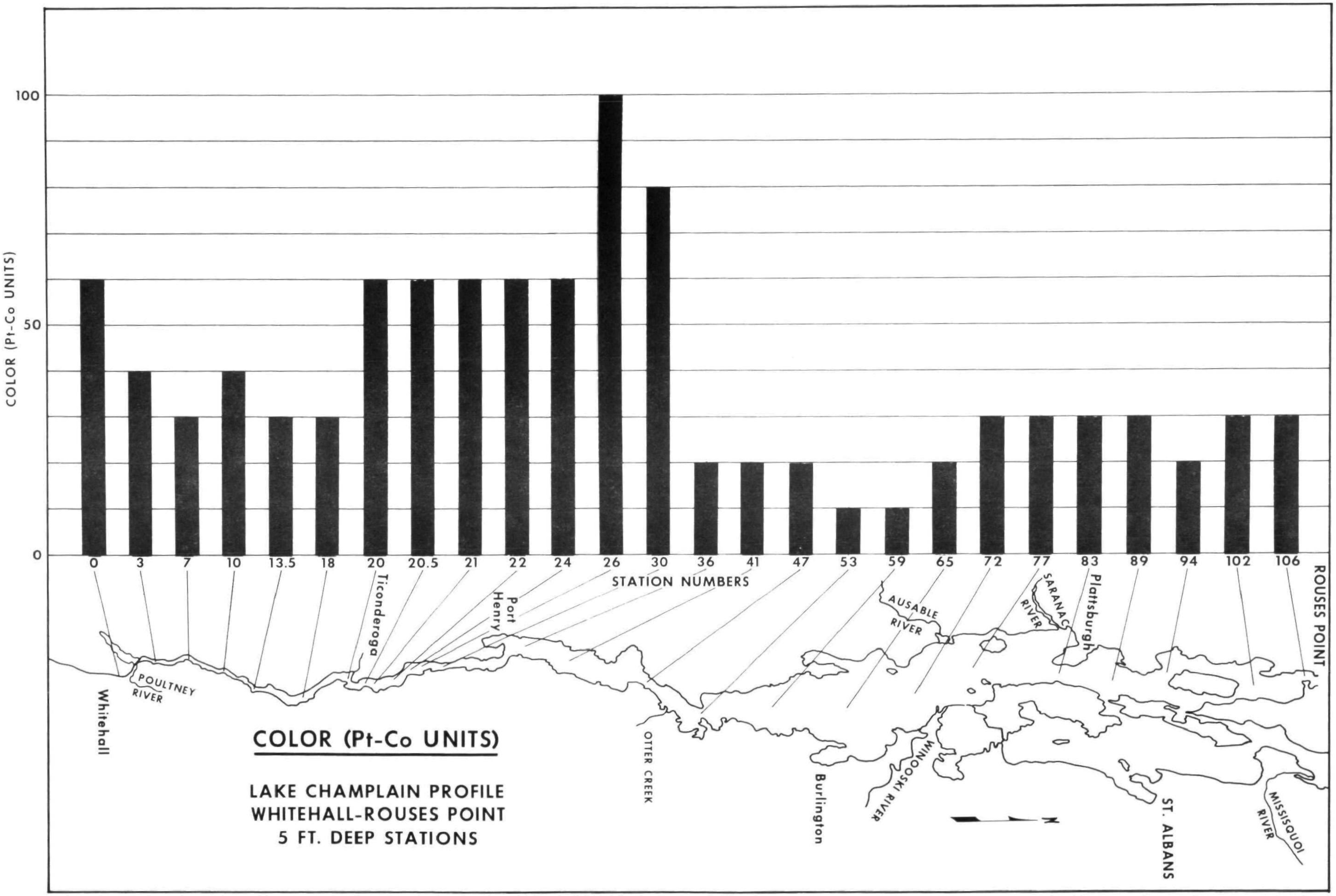
to 0.04 mg/l as phosphorus (0.03 to 0.12 mg/l as phosphate) have been reported as being able to support prolific growths of both suspended and attached algae. The generally accepted value for the minimum concentration of nitrogen required for algal growths in fresh water is 0.3 mg/l as nitrogen.

Results of the FWPCA study show that although most stations had values of phosphate and nitrogen above the critical levels, algal blooms were not encountered. Attached filamentous algae and rooted aquatic plants were limited to a narrow band near the shore. St. Albans Bay, Vermont, is one area where a significant algal problem exists.

Color and Transparency

Color in surface waters may be the result of natural phenomena such as land runoff, or may originate from industrial or other waste discharges. Transparency, as recorded by Secchi disc readings, is a measure of the clarity of water. Transparency is affected by the presence of suspended solids and color.

Figures IV-7 and IV-8 show the color and transparency, respectively, of Lake Champlain from Whitehall to Rouses Point. Both profiles emphasize the drastic difference between the southern part and the main body of the Lake. Principal factors which contribute to the increased color and reduced transparency in the southern part are: (a) resuspension of settled material by the passage of commercial vessels because of the shallow depth; (b) suspended solids and color discharged from a large pulp and paper mill to Ticonderoga Creek; and (c) the discharge of inert suspended solids from slate and quarrying operations along the Poultney River and its tributaries.



COLOR (Pt-Co UNITS)
100
50
0
0
3
7
10
13.5
18
20
20.5
21
22
24
26
30
36
41
47
53
59
65
72
77
83
89
94
102
106
STATION NUMBERS
Whitehall
POULTNEY RIVER
Ticonderoga
Port Henry
OTTER CREEK
Burlington
WINOOSKI RIVER
AUSABLE RIVER
SARANAC RIVER
Plattsburgh
ST. ALBANS
MISSISQUOI RIVER
ROUSES POINT
COLOR (Pt-Co UNITS)
LAKE CHAMPLAIN PROFILE
WHITEHALL-ROUSES POINT
5 FT. DEEP STATIONS

Figure IV-7

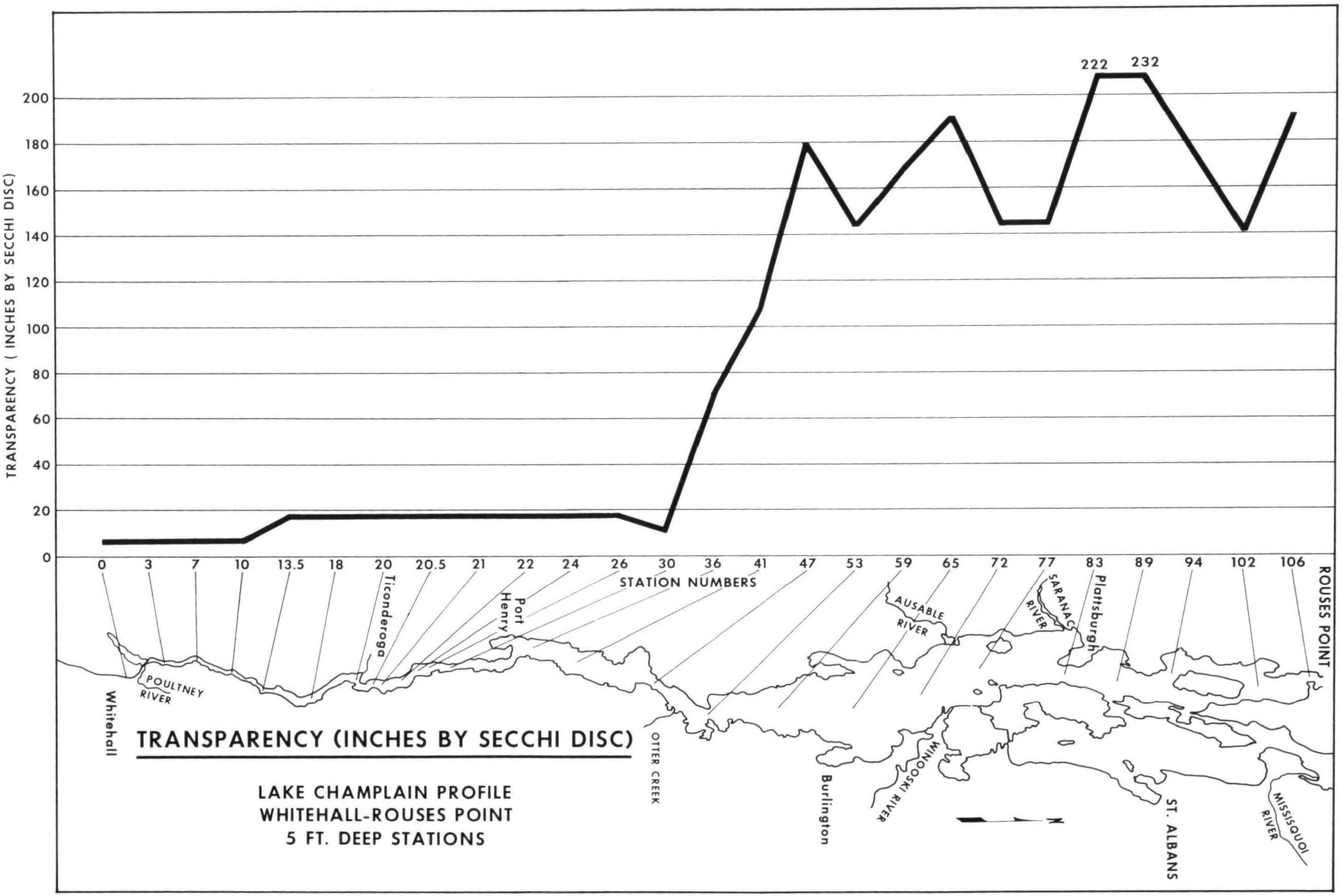

TRANSPARENCY (INCHES BY SECCHI DISC)
0
20
40
60
80
100
120
140
160
180
200
222
232
0
3
7
10
13.5
18
20
20.5
21
22
24
26
30
36
41
47
53
59
65
72
77
83
89
94
102
106
STATION NUMBERS
Whitehall
POULTNEY RIVER
Ticonderoga
Port Henry
OTTER CREEK
Burlington
WINOOSKI RIVER
AUSABLE RIVER
SARANAC RIVER
Plattsburgh
ST. ALBANS
MISSISQUOI RIVER
ROUSES POINT
TRANSPARENCY (INCHES BY SECCHI DISC)
LAKE CHAMPLAIN PROFILE
WHITEHALL-ROUSES POINT
5 FT. DEEP STATIONS

Figure IV-8

V - POLLUTION CONTROL PROGRAMS

State Programs

The Water Quality Act of 1965 amended the Federal Water Pollution Control Act and provided for the establishment of water quality standards for interstate waters. Under the provisions of the Act, the States were given the option of setting water quality standards by June 30, 1967, for interstate waters or portions thereof within their borders. The standards established had to be consistent with the purposes of the Act which are "...to enhance the quality and value of our water resources and to establish a national policy for the prevention, control, and abatement of water pollution."

The Act provides that the standards adopted by the States must include water quality criteria applicable to the interstate waters or portions thereof within the State, and a plan for the implementation and enforcement of the water quality criteria adopted. The Act further provides that the standards of quality adopted shall be such as to protect the public health or welfare, enhance the quality of the water and serve the purposes of the Act. In establishing such standards on interstate waters, consideration was to be given to their use and value for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other legitimate uses.

The criteria and implementation plans adopted by the States are subject to approval by the Secretary of the Interior. If the Secretary determines that these are consistent with the provisions of the Act, they become the water quality standards applicable to those interstate waters.

New York

The New York Water Pollution Control Act of 1949 established a program of stream classifications for designated waters of the State. After a series of public hearings in August 1955, the State adopted water quality standards for the Lake Champlain drainage basin. In response to the Federal Water Quality Act of 1965, New York was one of the first States in the nation to secure approval from the Federal government of quality standards for interstate waters. Appendix A presents the classifications and water quality criteria for Lake Champlain and its interstate tributaries submitted to the Secretary of the Interior by New York State. Table A-1 summarizes the water pollution abatement schedule for waste sources as established by New York State in order to achieve compliance with the standards. According to this schedule, the industrial polluters under orders will complete remedial facilities by July 1970. Those municipal sources which are under orders will have facilities completed during 1970. Three municipalities have voluntary compliance schedules to provide remedial facilities by April 1972.

Vermont

The State of Vermont passed basic legislation on water pollution control in 1949. Since the enactment of this legislation, the State has completed classification of waters in approximately 40 percent of its land area. In response to the Federal Water Quality Act of 1965, Vermont recently received Federal approval of water quality standards (with exceptions) for interstate waters. The exceptions did not refer to the classification of waters in the Lake Champlain drainage basin but did refer to the criteria established for certain classifications. Appendix B presents the classifications and water quality criteria for Lake Champlain and its interstate tributaries submitted to the Secretary of the Interior by the State of Vermont. Table B-1 summarizes the water pollution abatement schedule for waste sources as established by Vermont in order to achieve compliance with the standards. According to this schedule, industrial polluters are under orders to complete remedial facilities by December 1968, with the exception of one source, which is scheduled for completion by December 1972. Municipalities which are under orders will have facilities completed by September 1970, with the exception of two sources, one of which is scheduled for completion by June 1971 and the other for January 1972.

General

Comparison of the best usage and the specific criteria for adjacent classified waters of the respective States reveals some differences. The water quality standards accepted for the waters of Lake Champlain range from a "B" in Vermont to "AA" through "C" in New York. New York State held a hearing on October 9, 1968, to consider the reclassification of its waters of lower Lake Champlain from "C" to "B". Should this proposed reclassification become effective, only a small portion of Lake Champlain (Deep Bay) would remain as a "C".

In the main body of the Lake, the Vermont "B" includes such water uses as bathing and public water supply with appropriate treatment while the New York "AA" uses include water supply for drinking, culinary or food processing purposes. In the lower portion of the Lake, the Vermont "B" is as previously defined, the present New York "C" is for fishing and the proposed reclassification to "B" would provide for bathing and any other usage except as a source of water supply. Differences also exist in specific criteria for these classifications, particularly dissolved oxygen, coliform density and temperature.

Interstate Program

Both New York and Vermont are signatory members of the New England Interstate Water Pollution Control Commission, which coordinates the water pollution control activities of the member states. The Technical Advisory Board of the Commission furthers the technical aspects of the program by the exchange of information as well as through the mechanism of research contracts. Of particular note with respect to this latter operation are research studies on the problems of paper, textile, and other wastes conducted under contract with the Commission. New York State's role in the Commission is limited to waters shared jointly by New York and the New England States, e.g., Lake Champlain.

A quasi-official interstate body, INCOCHAMP (Interstate Commission on the Champlain Basin) has operated in the past to bring together resource management personnel from New York and Vermont to plan orderly development of the land and water resources of the Champlain basin. Although no official compact was created to authorize this agency, both States have had tentative statutory approval to create the Lake Champlain Basin Compact. Once established, this compact will serve as a formal planning authority charged with the responsibility of planning land and water resources within the Basin including such activities as water pollution control.

Construction Grant Program

In the Lake Champlain drainage basin to date, the Federal Water Pollution Control Administration has spent or allocated about $7.9 million of the area's total waste facilities construction cost of $26.1 million. This includes 12 projects in New York with a $0.95 million FWPCA allocation and $5.7 million total construction costs, and 36 projects in Vermont with a $6.98 million FWPCA allocation and $20.4 million total construction costs. Table V-1 lists these projects.

TABLE V-1

FEDERAL GRANTS FOR THE CONSTRUCTION OF SEWAGE TREATMENT WORKS

LAKE CHAMPLAIN BASIN

NEW YORK

Name of Project	Proj. No.	Eligible Costs	Amount of Grant	Date of Grant	Description of Project *	Status**
Bolton Landing (T)	WPC-NY-14	$362,800	$ 108,839	4-59	STP, INT, PS, FM	3
Rouses Point (V)	WPC-NY-27	426,900	128,058	4-57	STP, OS, INT, PS, FM	3
Plattsburgh (C)	WPC-NY-124	14,300	4,278	8-61	STP (A)	3
Plattsburgh (C)	WPC-NY-127	46,900	14,053	8-61	STP (A), Trunk Sewer	3
Champlain (V)	WPC-NY-139	312,900	93,892	12-61	STP, INT	3
Dannemora (V)	WPC-NY-153	167,900	50,384	12-61	STP, INT	3
Port Henry (V)	APW-NY-180	334,900	162,500 (APW)	6-63	STP, PS, FM, INT	3
Lake George (V)	APW-NY-194	291,000	145,500 (APW)	1-64	STP (A)	3
Lake George (T)	WPC-NY-284	590,300	177,090	5-66	INT, PS, FM	2
Keeseville (V)	WPC-NY-353	660,300	35,000	4-67	STP, INT, FM, PS	1
Lake Placid (V)	WPC-NY-442	1,407,000	15,470	4-68	INT, PS, STP, (A)	1
Saranac Lake (V)	WPC-NY-443	1,081,300	11,890	4-68	INT, PS, STP (A)	1
TOTALS - New York	12 Projects	$5,696,500	$946,954			

TABLE V-1

LAKE CHAMPLAIN BASIN (Cont'd)

VERMONT

Name of Project	Proj. No.	Eligible Costs	Amount of Grant	Date of Grant	Description of Project *	Status**
S. Burlington F. D. #4	WPC-Vt-1	$124,400	$ 37,307	2-57	STP, OS (A)	3
Burlington (C)	WPC-Vt-2	613,400	184,033	3-57	STP, INT	3
Barre (C)	WPC-Vt-4	522,000	156,588	4-58	STP, OS, INT	3
St. Albans (C)	WPC-Vt-6	668,800	200,641	9-58	STP (A)	3
Shelburne (T)	WPC-Vt-7	54,000	16,200	12-58	STP	3
Brandon (T)	WPC-Vt-10	698,500	209,540	7-59	STP, OS, INT	3
Rutland (C)	WPC-Vt-11	989,000	250,000	1-60	STP, OS, INT	3
Proctor (V)	WPC-Vt-13	506,800	152,027	1-60	STP, OS, INT	3
Essex Junction (V)	WPC-Vt-15	429,900	128,970	6-61	STP, OS, INT	3
Vermont Teachers Coll.	WPC-Vt-16	30,000	8,512	7-61	STP	3
Burlington (C)	WPC-Vt-17	51,600	15,487	12-61	INT	3
Burlington (C)	WPC-Vt-18	616,600	184,982	12-61	STP, INT	3
Montpelier (C)	WPC-Vt-19	1,839,200	551,763	9-62	STP, INT	3
Barre (T)	WPC-Vt-22	807,300	242,201	2-63	STP, INT (A)	3
Newport (C)	APW-WPC-Vt-24	1,584,900	78,268 (WPC) 714,182 (APW)	5-65	STP, INT (A)	3
Vergennes (C)	WPC-Vt-27	477,900	143,367	6-63	STP, OS, INT	3

TABLE V-1

LAKE CHAMPLAIN BASIN (Cont'd)

VERMONT (Cont'd)

Name of Project	Proj. No.	Eligible Costs	Amount of Grant	Date of Grant	Description of Project *	Status**
Middlebury (V)	WPC-Vt-29	$1,051,700	$315,510	12-63	STP, INT (A)	2
Northfield (V)	WPC-Vt-30	1,360,500	408,135	3-64	STP, INT	3
Vermont Bldgs Division	WPC-Vt-31	20,700	6,209	9-64	STP (A)	3
Minooski (C)	WPC-Vt-32	900,000	270,000	11-64	STP, INT	1
Rutland (T)	WPC-Vt-33	109,300	32,788	12-64	STP, INT	3
Berlin (T)	WPC-Vt-34	525,900	157,781	2-65	STP, INT (A)	3
Rutland (C)	WPC-Vt-36	102,800	30,830	5-65	INT (A)	3
Burlington (C)	WPC-Vt-39	68,300	20,502	6-65	INT (A)	3
S. Burlington (T)	WPC-Vt-40	1,540,000	508,198	8-65	STP, OS, INT	3
Essex Junction (V)	WPC-Vt-41	28,600	8,565	10-65	INT	3
Pittsford (T)	WPC-Vt-42	238,000	71,400	2-66	STP, INT	2
Barre (C)	WPC-Vt-44	110,100	33,018	3-66	INT (A)	3
Hinesburg (T)	WPC-Vt-45	610,700	244,300	4-66	STP	2
Waterbury (V)	WPC-Vt-46	634,600	253,840	5-66	STP, INT	2
Vermont State Coll.	WPC-Vt-47	284,900	85,470	10-66	INT (A)	2
Plainfield (V)	WPC-Vt-48	416,800	166,730	5-67	STP, INT	2

TABLE V-1

LAKE CHAMPLAIN BASIN (Cont'd)

VERMONT (Cont'd)

Name of Project	Proj. No.	Eligible Costs	Amount of Grant	Date of Grant	Description of Project *	Status**
Johnson (V)	WPC-Vt-50	$527,900	$ 211,160	9-67	STP, INT	2
Colchester F. D. #1	WPC-Vt-52	758,100	333,540	12-67	STP, INT	2
Shelburne F. D. #1	WPC-Vt-53	1,038,000	519,000	8-68	STP, OS, INT	1
Northfield (V)	WPC-Vt-54	74,000	29,600	7-68	STP (A)	1
TOTALS - Vermont	36 Projects	$20,415,200	$6,980,644			
TOTALS - Lake Champlain Basin	48 Projects	$26,111,700	$7,927,598			

* Description of Project:

(A) - Additions and/or Alterations
FM - Force Main
INT - Intercepting Sewers
OS - Outfall Sewer
PS - Pumping Station
STP - Sewage Treatment Plant

** Status:

1 - Offer made

2 - Under Construction

3 - Project completed

September 20, 1968

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APPENDIX A

NEW YORK STREAM CLASSIFICATION

1. Classification-Lake Champlain and Interstate Tributaries

2. Water Quality Criteria

3. Water Pollution Abatement Schedule

INTERSTATE WATERS WITHIN NEW YORK STATE
ST. LAWRENCE RIVER BASIN
OFFICIAL CLASSIFICATIONS - LAKE CHAMPLAIN & INTERSTATE TRIBUTARIES

	Area of Lake Champlain or Tributaries	Primary Present & Future Uses	Class	Standards
	Lake Champlain			
1	Located between the States of New York and Vermont. All shoreside waters extending outward from the mainland at least one-quarter mile from the shoreline to a depth of thirty feet and beyond where necessary in the section beginning at the New York - Quebec (United States-Canada) boundary and extending along the westerly shoreline to the Lake Champlain Toll Bridge at Crown Point, with the exception of the following waters; Deep Bay, Cumberland Bay, the shoreside waters from Cumberland Bay southward to Ausable Point, Willsboro Bay, North West Bay and Bulwagga Bay.	Domestic water consumption, recreation, fishing, agriculture, navigation, waste disposal	A	A
2	Deep Bay, which is located to the northeast of Treadwell Bay and 5.3 miles east of the hamlet of Beekmantown	Fishing, recreation, agriculture	C	C
3	Portion of Cumberland Bay, which is located east of the City of Plattsburgh and on the westerly side of Lake Champlain. Included is that portion lying westerly of the line beginning at a landpoint to be found on the westerly shore of the peninsula called Cumberland Head 0.75 mile south, southeasterly of the northmost part of Cumberland Bay proper and extending from this point in a southwesterly direction to the shore end of the City of Plattsburgh.	Recreation, fishing, navigation, waste disposal	B	B
4	That portion of Cumberland Bay lying easterly and southerly of the line from the south line of the City of Plattsburgh and extending to Cumberland Head as described in the preceding item and westerly of the line beginning at Cumberland Head Lighthouse and extending southwesterly	Domestic water consumption, recreation, fishing, navigation	A	A

	Area of Lake Champlain or Tributaries	Primary Present & Future Uses	Class	Standards
	Lake Champlain - cont'd			
4	to the northmost point of Crab Island, thence running northwesterly to the shore at the south line of the City of Plattsburgh.			
5	That portion of the lake enclosed by the lines described as follows: from the shore at the south line of the City of Plattsburgh to the northmost point of Crab Island; from the southmost point of Crab Island to the northmost point of Valcour Island; from the southmost point of Valcour Island to Ausable Point. Included are the areas around Crab Island and Valcour Island extending outward at least one-quarter mile from the shoreline and beyond where necessary to a depth of thirty feet.	Domestic water consumption, recreation, fishing, agriculture	A	A
6	Willsboro Bay, located north of the hamlet of Willsboro. Included is all that section inclosed by a line from the northmost point of Willsboro Point westerly to the mouth of Trib. 40 which enters Lake Champlain from the west 2.7 miles southeasterly of Port Douglas.	Domestic water consumption, recreation, fishing, agriculture	AA	AA
7	North West Bay, which is located on the westerly side of Lake Champlain and east of the Village of Westport. Included are the waters lying westerly and north of the line beginning at the point of the headland between Partridge Harbor and Hunter Bay and running southerly to an intersection with the New York-Vermont State line and a line directly east from the shoreline at Bluff Point.	Domestic water consumption, recreation, fishing, agriculture, waste disposal	A	A

	Area of Lake Champlain or Tributaries	Primary Present & Future Uses	Class	Standards
	Lake Champlain - cont'd			
8	Bulwagga Bay, which is located to the south and slightly east of the Village of Port Henry.	Recreation, fishing, agriculture	B	B
9	Open reaches of the lake within New York State in the section beginning at the New York-Quebec (United States-Canada) border and extending southerly to the Lake Champlain Toll Bridge at Crown Point. Excluded are the sections described previously as "shoreside waters", Deep Bay, Cumberland Bay, the shoreside waters from Cumberland Bay to Ausable Point, Willsboro Bay, North West Bay, and Bulwagga Bay.	Domestic water consumption, recreation, fishing, navigation	AA	AA
10	That portion of Lake Champlain within New York State lying south of the Lake Champlain Toll Bridge at Crown Point and including South Bay.	Fishing, recreation, agriculture, navigation, waste disposal	C	C
	Mettawee River and Barge Canal			
11	Enters Lake Champlain from the southeast at the south shore of East Bay and 0.8 mile north of the Village of Whitehall. Mouth to a point 2.1 miles upstream from the mouth and at the confluence of the Barge Canal with the Mettawee River and 0.8 mile south of the south line of the Village of Whitehall.	Fishing, recreation, agriculture, navigation, waste disposal	C	C
	Mettawee River			
12	From the confluence with the Barge Canal upstream to Trib. 15. Trib. 15 enters from the southeast 0.2 mile east of the intersection of the Fort Ann-Granville-	Fishing, recreation, agriculture.	C	C

	Area of Lake Champlain or Tributaries	Primary Present & Future Uses	Class	Standards
	Mettawee River - cont'd			
12	Whitehall township lines and 2.2 miles north of the hamlet of West Granville.			
13	From Trib. 15 to the New York-Vermont Boundary line at the east boundary of the Village of Granville.	Fishing, recreation, agriculture, waste disposal.	C	C(T)
	Poultney River			
14	Enters Lake Champlain from the northmost part of East Bay 2.8 miles north of the peak of Warner Hill and 3.2 miles northwest of the peak of Hampton Hill. Mouth to Carver Falls which are located 3.8 miles upstream from the mouth and 2.2 miles north of the peak of Hampton Hill. Included are the portions of the waters within New York State.	Fishing, recreation, agriculture.	C	C
15	From Carver Falls upstream to the point where the river leaves New York State 2.6 miles east of the peak of Thorn Hill and 0.9 mile south of the hamlet of Hampton. Included are the portions of the waters within New York State.	Fishing, recreation	C	C(T)

WATER QUALITY CRITERIA

STATE OF NEW YORK

CLASS AA

DEFINITION OR BEST USAGE: Source of water supply for drinking, culinary or food processing purposes and any other usages.

FLOW CONDITIONS:

1	Floating Solids	None attributable to sewage, industrial wastes or other wastes.
2	Setteable Solids	None attributable to sewage, industrial wastes or other wastes.
3	Sludge Deposits	None attributable to sewage, industrial wastes or other wastes.
4	Solid Refuse, Garbage, Cinders, Ashes, Oils, Sludge or Other Refuse	Not Specified
5	Sewage or Other Effluent	None which are not effectively disinfected.
6	Oil, Grease, Oil Slicks, or Scum	Oil: None attributable to sewage, industrial wastes or other wastes.
7	Coliform Density	For series of 4 or more samples collected during any 30-day period: Average MPN not more than 50/100ml.; MPN of more than 50/100ml. in not more than 20% of samples collected.
8	pH	Range between 6.5 and 8.5.
9	Dissolved Oxygen	For trout waters, not less than 5.0 ppm. For non-trout waters, not less than 4.0 ppm.
10	Color	See Number 13.
11	Turbidity	Not Specified.
12	Taste, Odor	None attributable to sewage, industrial wastes or other wastes.
13	Toxic Wastes, Deleterious Substances:	See over.
14	Heated Effluents and Temperature Criteria:	See over.

REMARKS: The waters, if subjected to approved disinfection treatment, with additional treatment if necessary to remove naturally present (Cont'd.)

WATER QUALITY CRITERIA STATE OF NEW YORK

CLASS AA (Cont'd.)

13 Toxic Wastes, Deleterious Substances:

None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to be injurious to fish life, make the waters unsafe or unsuitable as a source of water supply for drinking, culinary or food processing purposes or impair the waters for any other best usage as determined for the specific waters which are assigned to this class.

14(a) Heated Effluents:

See Number 13.

(b) Temperature Criteria:

(i) Trout waters:

No thermal discharges that would adversely affect the fishery.

(ii) Non-trout waters:

Within the mixing zone stream temperature shall not exceed 90°F.

Outside the mixing zone stream temperature shall not exceed 86°F after mixing; no permanent change in excess of 5 F° above normal will be permitted; rate of temperature change shall be limited to 2 F° per hour, not to exceed 9 F° in any 24-hour period; average change for 7-day period shall be less than 5 F° above normal.

REMARKS (Cont'd.):

impurities, meet or will meet U. S. Public Health Service Drinking Water Standards and are or will be considered safe and satisfactory for drinking water purposes.

In determining the safety or suitability of waters in this class for use as a source of water supply for drinking, culinary or food processing purposes after approved treatment, the latest edition of "Public Health Service Drinking Water Standards" published by the United States Public Health Service will be used as the guide.

Based on non-trout waters of approximately median alkalinity (80 p.p.m.) or above for the state and without considering effects of combinations, the following may be considered as safe stream concentrations for this class of water. Waters of lower alkalinity must be specially considered since the toxic effect of most pollutants will be greatly increased.

Ammonia or Ammonium compounds: Not greater than 2.0 ppm at pH of 8.0 or above.
Ferro- or Ferricyanide : Not greater than 0.4 ppm ($Fe(CN)_6$).
Cyanide: Not greater than 0.1 ppm (CN). Copper: Not greater than 0.2 ppm (Cu).
Zinc: : Not greater than 0.3 ppm (Zn). Cadium: Not greater than 0.3 ppm (Cd).

WATER QUALITY CRITERIA

STATE OF NEW YORK

CLASS A

DEFINITION OR BEST USAGE: Source of water supply for drinking, culinary or food processing purposes and any other usages.

FLOW CONDITIONS:

1	Floating Solids	None which are readily visible and attributable to sewage, industrial wastes or other wastes or which deleteriously increase the amounts of these constituents in receiving waters after opportunity for reasonable dilution and mixture with the wastes discharged thereto.
2	Settleable Solids	See Number 1.
3	Sludge Deposits	See Number 1.
4	Solid Refuse, Garbage, Cinders, Ashes, Oils, Sludge or Other Refuse	Not Specified.
5	Sewage or Other Effluent	None which are not effectively disinfected.
6	Oil, Grease, Oil Slicks, or Scum	Oil: See Number 13(a).
7	Coliform Density	For series of 4 or more samples collected during any 30-day period: Average MPN not to exceed 5000/100ml.; MPN exceeding 5000/100ml. in not more than 20% of samples collected.
8	pH	Range between 6.5 and 8.5.
9	Dissolved Oxygen	For trout waters, not less than 5.0 ppm. For non-trout waters, not less than 4.0 ppm.
10	Color	See Number 13(a).
11	Turbidity	Not Specified.
12	Taste, Odor	Odor producing substances contained in wastes: The waters, after opportunity for reasonable dilution and mixture with wastes discharged thereto, shall not have an increased threshold odor number greater than 8 due to such added wastes.
13	Toxic Wastes, Deleterious Substances:	See over.
14	Heated Effluents and Temperature Criteria:	See over.

REMARKS: The waters, if subjected to approved treatment equal to (Cont'd.)

13(a) Toxic Wastes, Deleterious Substances:

None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to be injurious to fish life, make the waters unsafe or unsuitable as a source of water supply for drinking, culinary or food processing purposes or impair the waters for any other best usage as determined for the specific waters which are assigned to this class.

(b) Phenolic Compounds:

Not greater than 5 parts per billion (Phenol).

14(a) Heated Effluents:

See Number 13(a).

(b) Temperature Criteria:

(i) Trout waters:

No thermal discharges that would adversely affect the fishery.

(ii) Non-trout waters:

Within the mixing zone, stream temperature shall not exceed 90°F.

Outside the mixing zone, stream temperature shall not exceed 86°F after mixing; no permanent change in excess of 5 F° above normal will be permitted; rate of temperature change shall be limited to 2 F° per hour, not to exceed 9 F° in any 24-hour period; average change for 7-day period shall be less than 5 F° above normal.

REMARKS (Cont'd.):

coagulation, sedimentation, filtration, and disinfection, with additional treatment if necessary to reduce naturally present impurities, meet or will meet U. S. Public Health Service Drinking Water Standards and are or will be considered safe and satisfactory for drinking water purposes.

In determining the safety or suitability of waters in this class for use as a source of water supply for drinking, culinary or food processing purposes after approved treatment, the latest edition of "Public Health Service Drinking Water Standards" published by the United States Public Health Service will be used as the guide.

Based on non-trout waters of approximately median alkalinity (80 p.p.m.) or above for the state and without considering effects of combinations, the following may be considered as safe stream concentrations for this class of water. Waters of lower alkalinity must be specially considered since the toxic effect of most pollutants will be greatly increased:

Ammonia or Ammonium compounds: Not greater than 2.0 ppm at pH of 8.0 or above.

Ferro- or Ferricyanide : Not greater than 0.4 ppm (Fe(CN)6).

Cyanide: Not greater than 0.1 ppm (CN). Copper: Not greater than 0.2 ppm (Cu).

Zinc: : Not greater than 0.3 ppm (Zn). Cadium: Not greater than 0.3 ppm (Cd).

WATER QUALITY CRITERIA

STATE OF NEW YORK

CLASS B

DEFINITION OR BEST USAGE: Bathing and any other usages except as a source of water supply for drinking, culinary or food processing purposes.

FLOW CONDITIONS:

1	Floating Solids	None which are readily visible and attributable to sewage, industrial wastes or other wastes or which deleteriously increase the amounts of these constituents in receiving waters after opportunity for reasonable dilution and mixture with the wastes discharged thereto.
2	Settleable Solids	See Number 1.
3	Sludge Deposits	See Number 1.
4	Solid Refuse, Garbage, Cinders, Ashes, Oils, Sludge or Other Refuse	Not Specified.
5	Sewage or Other Effluent	None which are not effectively disinfected.
6	Oil, Grease, Oil Slicks, or Scum	Oil: See Number 13.
7	Coliform Density	For series of 4 or more samples collected during any 30-day period: Average MPN not to exceed 2400/100ml.; MPN exceeding 2400/100ml. in not more than 20% of samples collected.
8	pH	Range between 6.5 and 8.5.
9	Dissolved Oxygen	For trout waters, not less than 5.0 ppm. For non-trout waters, not less than 4.0 ppm.
10	Color	See Number 13.
11	Turbidity	Not Specified.
12	Taste, Odor	Not Specified.
13	Toxic Wastes, Deleterious Substances:	See over.
14	Heated Effluents and Temperature Criteria:	See over.

REMARKS:

13 Toxic Wastes, Deleterious Substances:

None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to be injurious to fish life, make the waters unsafe or unsuitable for bathing or impair the waters for any other best usage as determined for the specific waters which are assigned to this class.

14(a) Heated Effluents:

See Number 13.

(b) Temperature Criteria:

(i) Trout waters:

No thermal discharges that would adversely affect the fishery.

(ii) Non-trout waters:

Within the mixing zone, stream temperature shall not exceed 90°F.

Outside the mixing zone, stream temperature shall not exceed 86°F after mixing; no permanent change in excess of 5 F° above normal will be permitted; rate of temperature change shall be limited to 2 F° per hour, not to exceed 9 F° in any 24-hour period; average change for 7-day period shall be less than 5 F° above normal.

REMARKS (Cont'd):

In determining the safety or suitability of waters in this class for use as a source of water supply for drinking, culinary or food processing purposes after approved treatment, the latest edition of "Public Health Service Drinking Water Standards" published by the United States Public Health Service will be used as the guide.

Based on non-trout waters of approximately median alkalinity (80 p.p.m.) or above for the state and without considering effects of combinations, the following may be considered as safe stream concentrations for this class of water. Waters of lower alkalinity must be specially considered since the toxic effect of most pollutants will be greatly increased:

Ammonia or Ammonium compounds: Not greater than 2.0 ppm at pH of 8.0 or above.
Ferro- or Ferricyanide : Not greater than 0.4 ppm (Fe(CN)6).
Cyanide: Not greater than 0.1 ppm (CN). Copper: Not greater than 0.2 ppm (Cu).
Zinc : Not greater than 0.3 ppm (Zn). Cadium: Not greater than 0.3 ppm (Cd).

WATER QUALITY CRITERIA

STATE OF NEW YORK

CLASS C

DEFINITION OR BEST USAGE: Fishing and any other usages except for bathing or as source of water supply for drinking, culinary or food processing purposes.

FLOW CONDITIONS:

1	Floating Solids	None which are readily visible and attributable to sewage, industrial wastes or other wastes or which deleteriously increase the amounts of these constituents in receiving waters after opportunity for reasonable dilution and mixture with the wastes discharged thereto.
2	Settleable Solids	See Number 1.
3	Sludge Deposits	See Number 1.
4	Solid Refuse, Garbage, Cinders, Ashes, Oils, Sludge or Other Refuse	Not Specified.
5	Sewage or Other Effluent	Not Specified.
6	Oil, Grease, Oil Slicks, or Scum	Oil: See Number 13.
7	Coliform Density	Not Specified.
8	pH	Range between 6.5 and 8.5.
9	Dissolved Oxygen	For trout waters, not less than 5.0 ppm. For non-trout waters, not less than 4.0 ppm.
10	Color	See Number 13.
11	Turbidity	Not Specified.
12	Taste, Odor	Not Specified.
13	Toxic Wastes, Deleterious Substances:	See over.
14	Heated Effluents and Temperature Criteria:	See over.

REMARKS:

13 Toxic Wastes, Deleterious Substances:

None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to be injurious to fish life or impair the waters for any other best usage as determined for the specific waters which are assigned to this class.

14(a) Heated Effluents:

See Number 13.

(b) Temperature Criteria:

(i) Trout waters:

No thermal discharges that would adversely affect the fishery.

(ii) Non-trout waters:

Within the mixing zone, stream temperature shall not exceed 90°F.

Outside the mixing zone, stream temperature shall not exceed 86°F after mixing; no permanent change in excess of 5 F° above normal will be permitted; rate of temperature change shall be limited to 2 F° per hour, not to excees 9 F° in any 24-hour period; average change for 7-day period shall be less than 5 F° above normal.

REMARKS (Cont'd):

In determining the safety or suitability of waters in this class for use as a source of water supply for drinking, culinary or food processing purposes after approved treatment, the latest edition of "Public Health Service Drinking Water Standards" published by the United States Public Health Service will be used as the guide.

Based on non-trout waters of approximately median alkalinity (80 p.p.m.) or above for the state and without considering effects of combinations, the following may be considered as safe stream concentrations for this class of water. Waters of lower alkalinity must be specially considered since the toxic effect of most pollutants will be greatly increased:

Ammonia or Ammonium compounds: Not greater than 2.0 ppm at pH of 8.0 or above.
Ferro- or Ferricyanide : Not greater than 0.4 ppm (Fe(CN)6).
Cyanide: Not greater than 0.1 ppm (CN). Copper: Not greater than 0.2 ppm (Cu).
Zinc : Not greater than 0.3 ppm (Zn). Cadium: Not greater than 0.3 ppm (Cd).

TABLE A-1

WATER POLLUTION ABATEMENT SCHEDULE
MUNICIPAL AND INDUSTRIAL WASTE SOURCES, NEW YORK
LAKE CHAMPLAIN BASIN 1/, 2/

Waste Source	Receiving Water	Report Due	Submit Final Plans	Start Constr.	Complete Constr.
	MUNICIPAL				
Granville	Mettawee R.	5/67	1/68	9/68	1/70
Whitehall	Mettawee R.	-	5/68	4/69	9/70
Ticonderoga Village	Ticonderoga Cr.	4/67	2/69	6/69	9/70
	(Atlernate)	4/67	2/69	4/69	7/70
Moriah SD #1	Lake Champlain				
Moriah SD #2	Lake Champlain				
Port Henry Village	Lake Champlain				4/72 3/
Mineville	Mill Brook Lake Champlain				
Grover Hill Housing	Mill Brook Lake Champlain				
Westport	Lake Champlain		4/68	4/69	12/70
Willsboro	Bouquet R.				4/72 3/
Keesville	Ausable R.				
Peru SD #1	Little Ausable R.				
Plattsburgh	Saranac R.	10/67	9/68	4/69	7/70
Champlain Park SD	Lake Champlain				
Chazy	Little Chazy R.				
Champlain Village	Great Chazy R.				
Rouses Point Village	Lake Champlain				4/72 3/
	INDUSTRIAL				
International Paper Co.	Ticonderoga Cr.	3/68	10/68	4/69	7/70
Republic Steel Corp.	Bartlett Brook Mill Brook				
J & J Rogers Co.	Ausable R.	5/68	5/69		
Imperial Paper Co.	Saranac R.		10/68	4/69	7/70
Diamond National Corp.	Lake Champlain		10/68	4/69	7/70
Georgia Pacific Corp.	Lake Champlain		10/68	4/69	7/70
Champlain Creameries	Great Chazy R.				

1/ Includes only those waste discharges that directly or indirectly affect the Lake.
2/ Schedules taken from New York Water Quality Standards as submitted to the Secretary of the Interior in May 1967 and the Existing Polluters, Legal Action Orders Issued listing included in the State FY-69 Programs Plan Submission.
3/ Under Department Directive (voluntary compliance).

APPENDIX B

VERMONT STREAM CLASSIFICATION

1. Classification-Lake Champlain and Interstate Tributaries
2. Water Quality Criteria
3. Water Pollution Abatement Schedule

INTERSTATE WATERS WITHIN VERMONT
OFFICIAL CLASSIFICATIONS - LAKE CHAMPLAIN & INTERSTATE TRIBUTARIES

	Area of Lake or Tributaries	Primary Present & Future Uses	Class
	Lake Champlain		
1	Entire Lake.	Bathing, other recreational purposes, agricultural uses, industrial processes and cooling, fishing and wildlife habitat, good aesthetic value.	B
2	Mettawee River	Bathing, other recreational purposes, agricultural uses, industrial processes and cooling, fishing and wildlife habitat, good aesthetic value.	B
3	Poultney River		
	Source to Middletown Springs	Same as above.	B
	Middletown Springs to Poultney Treatment Plant	" " "	B
	Poultney Treatment Plant to Lewis Creek	Fish and wildlife habitat; recreational boating, and industrial processes and cooling; under some conditions acceptable for public water supply with appropriate treatment; good aesthetic value.	C
	Lewis Creek to confluence with Castleton River	Same as 1 & 2 above.	B
	Confluence with Castleton River to Mud Brook	Fish and wildlife habitat; recreational boating, and industrial processes and cooling; under some condi-	C

	Area of Lake or Tributaries	Primary Present & Future Uses	Class
	Lake Champlain - cont'd		
3	Poultney River - cont d		
	Confluence with Castleton River to Mud Brook	cont'd tions acceptable for public water supply with appropriate treatment; good aesthetic value.	
	Mud Brook to mouth	Fish and wildlife habitat; recreational boating, and industrial processes and cooling; under some conditions acceptable for public water supply with appropriate treatment; good aesthetic value.	C
4	Missisquoi River		
	Scheduled for classification in 1969		

WATER QUALITY CRITERIA

(NOTE: Except where noted by an asterisk (*), these criteria have been approved by the Secretary of the Interior.)

STATE OF VERMONT

CLASS A

DEFINITION OR BEST USAGE: Suitable for water supply and all other water uses; character uniformly excellent.

FLOW CONDITIONS: Minimum average daily flow for 7 consecutive days with 10 year recurrence interval.

1	Floating Solids	None allowable.
2	Settleable Solids	Not Specified.
3	Sludge Deposits	None allowable.
4	Solid Refuse, Garbage, Cinders, Ashes, Oils, Sludge or Other Refuse	Solid Refuse: None allowable.
5	Sewage or Other Effluent	All sewage treatment plant effluents shall receive disinfection before discharge to the watercourse. The degree of treatment and disinfection shall be as required by the state pollution control agency.
6	Oil, Grease, Oil Slicks, or Scum	Oils, Grease, Scum: None allowable.
7	Coliform Density	Not to exceed a median of 100/100ml., nor more than 500 per 100ml. in more than 10% of samples collected.
8	pH	As naturally occurs.
9	Dissolved Oxygen	75% saturation, 16 hours per day; 5 mg/1 at any time.
10	Color	None other than of natural origin.
11	Turbidity	None other than of natural origin.
12	Taste, Odor	None other than of natural origin.
13	Toxic Wastes, Deleterious Substances:	See over.
14	Heated Effluents and Temperature Criteria:	See over.

REMARKS: Class A waters reserved for water supply may be subject to restricted use by state and local regulation. (Continued)

WATER QUALITY CRITERIA — STATE OF VERMONT

CLASS A (Cont'd.)

13 Toxic Wastes, Deleterious Substances:

Waters shall be free from chemical constituents in concentrations or combinations which would be harmful to human, animal, or aquatic life for the appropriate, most sensitive and governing water class use. In areas where fisheries are the governing considerations and approved limits have not been established, bioassays including assessment of taste and odor in edible fish shall be performed as required by the appropriate agencies. For public drinking water supplies the limits prescribed by the United States Public Health Service may be used where not superseded by more stringent signatory state requirements.

14(a) Heated Effluents:

Not Specified.

(b) Temperature Criteria - Allowable Temperature Increase:

None other than of natural origin.

REMARKS (Cont'd.):

These Standards do not apply to conditions brought about by natural causes. Radioactivity limits to be approved by the appropriate state agency with consideration of possible adverse effects in downstream waters from discharge of radioactive wastes; limits in a particular watershed to be resolved when necessary after consultation between states involved.

WATER QUALITY CRITERIA

(NOTE: Except where noted by an asterisk (*), these criteria have been approved by the Secretary of the Interior.)

STATE OF VERMONT

CLASS B

DEFINITION OR BEST USAGE: Suitable for bathing, other recreational purposes, agricultural uses, industrial processes and cooling; excellent fish and wildlife habitat; good aesthetic value; acceptable for public water supply with appropriate treatment.

FLOW CONDITIONS: Minimum average daily flow for 7 consecutive days with 10 year recurrence interval.

1	Floating Solids	None allowable.
2	Settleable Solids	Not Specified.
3	Sludge Deposits	None allowable.
4	Solid Refuse, Garbage, Cinders, Ashes, Oils, Sludge or Other Refuse	Solid Refuse: None allowable.
5	Sewage or Other Effluent	All sewage treatment plant effluents shall receive disinfection before discharge to the watercourse. The degree of treatment and disinfection shall be as required by the state pollution control agency.
6	Oil, Grease, Oil Slicks, or Scum	Oils, Grease, Scum: None allowable.
7	Coliform Density	Not to exceed a median of 1000/100ml., nor more than 2400 per 100ml. in more than 20% of samples collected.
8	pH	6.5 to 8.0.
9	Dissolved Oxygen	75% saturation, 16 hours per day; 5 mg/l at any time.
10	Color	None in such concentrations that would impair any usages specifically assigned to this Class.
11	Turbidity	None in such concentrations that would impair any usages specifically assigned to this Class.
12	Taste, Odor	None in such concentrations that would impair any usages specifically assigned to this Class.
13	Toxic Wastes, Deleterious Substances:	See over.
14	Heated Effluents and Temperature Criteria:	See over.

REMARKS: Class B waters shall be substantially free of pollutants that:

a) Unduly affect the composition of bottom fauna, (Continued)

WATER QUALITY CRITERIA STATE OF VERMONT

CLASS B (Cont'd.)

13 Toxic Wastes, Deleterious Substances:

Waters shall be free from chemical constituents in concentrations or combinations which would be harmful to human, animal, or aquatic life for the appropriate, most sensitive and governing water class use. In areas where fisheries are the governing considerations and approved limits have not been established, bioassays including assessment of taste and odor in edible fish shall be performed as required by the appropriate agencies. For public drinking water supplies the limits prescribed by the United States Public Health Service may be used where not superseded by more stringent signatory state requirements.

14(a) Heated Effluents:

Not Specified.

(b) Temperature Criteria - Allowable Temperature Increase:

Only such increases that will not impair any usages specifically assigned to this Class. In no case shall the temperature of the receiving water be raised more than 4 F°.

*For waters supporting cold water fisheries the temperature increase shall not raise the temperature of the receiving waters above 68°F.

For waters supporting a warm water fishery the temperature increase shall not raise the temperature of the receiving waters above 83°F.

REMARKS (Cont'd.):

b) Unduly affect the physical or chemical nature of the bottom,

c) Interfere with the propagation of fish.

These standards do not apply to conditions brought about by natural causes. Radioactivity limits to be approved by the appropriate state agency with consideration of possible adverse effects in downstream waters from discharge of radioactive wastes; limits in a particular watershed to be resolved when necessary after consultation between states involved.

WATER QUALITY CRITERIA (NOTE: Except where noted by an asterisk (*), these criteria have been approved by the Secretary of the Interior.)

STATE OF VERMONT

CLASS C

DEFINITION OR BEST USAGE: Suitable for fish and wildlife habitat; recreational boating, and industrial processes and cooling; under some conditions acceptable for public water supply with appropriate treatment; good aesthetic value.

FLOW CONDITIONS: Minimum average daily flow for 7 consecutive days with 10 year recurrence interval.

1	Floating Solids	None shall be allowed except for such small amounts that may result from the discharge of appropriately treated sewage or industrial waste effluents.
2	Settleable Solids	Not Specified.
3	Sludge Deposits	See Number 1.
4	Solid Refuse, Garbage, Cinders, Ashes, Oils, Sludge or Other Refuse	Solid Refuse: None.
5	Sewage or Other Effluent	All sewage treatment plant effluents shall receive disinfection before discharge to the watercourse. The degree of treatment and disinfection shall be as required by the state pollution control agency.
6	Oil, Grease, Oil Slicks, or Scum	Oils, Grease, Scum: See Number 1.
7	Coliform Density	None in such concentrations that would impair any usages specifically assigned to this Class.
8	pH	6.0 to 8.5.
*9	Dissolved Oxygen	5 mg/l, 16 hours per day; not less than 3 mg/l at any time. For cold water fishery, not less than 5 mg/l at any time.
10	Color	None in such concentrations that would impair any usages specifically assigned to this Class.
11	Turbidity	None in such concentrations that would impair any usages specifically assigned to this Class.
12	Taste, Odor	None in such concentrations that would impair any usages specifically assigned to this Class.
13	Toxic Wastes, Deleterious Substances:	See over.
14	Heated Effluents and Temperature Criteria:	See over.

REMARKS: Class C waters shall be substantially free of pollutants that:

a) Unduly affect the composition of bottom fauna, (Continued)

WATER QUALITY CRITERIA STATE OF VERMONT

CLASS C (Cont'd.)

13 Toxic Wastes, Deleterious Substances:

Waters shall be free from chemical constituents in concentrations or combinations which would be harmful to human, animal, or aquatic life for the appropriate, most sensitive and governing water class use. In areas where fisheries are the governing considerations and approved limits have not been established, bioassays including assessment of taste and odor in edible fish shall be performed as required by the appropriate agencies. For public drinking water supplies the limits prescribed by the United States Public Health Service may be used where not superseded by more stringent signatory state requirements.

14(a) Heated Effluents:

Not Specified.

(b) Temperature Criteria - Allowable Temperature Increase:

Only such increases that will not impair any usages specifically assigned to this Class. In no case shall the temperature of the receiving water be raised more than 4 F°.

*For waters supporting cold water fisheries the temperature increase shall not raise the temperature of the receiving waters above 68°F.

For waters supporting a warm water fishery the temperature increase shall not raise the temperature of the receiving waters above 83°F.

REMARKS (Cont'd.):

b) Unduly affect the physical or chemical nature of the bottom,

c) Interfere with the propagation of fish.

These Standards do not apply to conditions brought about by natural causes. Radioactivity limits to be approved by the appropriate state agency with consideration of possible adverse effects in downstream waters from discharge of radioactive wastes; limits in a particular watershed to be resolved when necessary after consultation between states involved.

TABLE B-1

WATER POLLUTION ABATEMENT SCHEDULE
MUNICIPAL AND INDUSTRIAL WASTE SOURCES, VERMONT
LAKE CHAMPLAIN BASIN 1/, 2/

Waste Source 4/	Receiving Water	Report Due	Submit Final Plans	Start Constr.	Complete Constr.
		MUNICIPAL 3/			
Shelburne FD #2	La Platte R.	x	2/69	5/69	9/70
S. Burlington FD #4	Potash Brook Shelburne Bay	x	2/69	5/69	9/70
Queen City Park	Potash Brook Shelburne Bay				
Burlington (Main Plant)	Lake Champlain	x	2/69	5/69	9/70
S. Burlington (Main Plant)	Winooski R.	x	2/69	5/69	9/70
Burlington (Riverside)	Winooski R.	x	2/69	5/69	9/70
Burlington (North End)	Winooski R.	x	2/69	5/69	9/70
Colchester FD #1	Winooski R.	x	x		
Winooski	Winooski R.	x	x		
St. Albans	Stevens Brook St. Albans Bay	x	2/69	5/69	9/70
Alburg	Lake Champlain	1/69	10/69	4/70	6/71
Swanton	Missisquoi R.	-	6/69	1/70	1/72
Shelburne FD #1 4/	Lake Champlain			9/68	1/70
		INDUSTRIAL 5/			
Fair Haven Mills	Castleton R.	3/68	7/68	9/69	12/68
Vermont Cut Slate	Castleton R.	3/68	7/68	9/68	12/68
Vermont Structural Slate, Fair Haven	Castleton R.	3/68	7/68	9/68	12/68
Vermont Structural Slate, Hydville	Castleton R.	3/68	7/68	9/68	12/68
Economu Cheese Co.	La Platte R.				
Louis E. Farrell	Lake Champlain				
John McKenzie Pkg.	Winooski R.				
Milton Co-op Dairy	Lamoille R.				
Missisquoi Specialty Board	Missisquoi R.	6/69	6/70	1/71	12/72
Vermont Dressed Beef	Missisquoi R.				

1/ Includes only those waste discharges that directly or indirectly affact the Lake.

2/ Schedules taken from Vermont Water Quality Standards as submitted to the Secretary of the Interior in June 1967 and as supplemented in September 1967.

3/ All other communities not listed and planning municipal collection and treatment shall submit a preliminary report by Januray 1, 1969, shall submit final plans by October 1, 1969, shall start construction by April 1, 1970 and shall complete construction no later than June 1, 1971. Where no municipal collection and treatment are contemplated it is assumed that pollution abatement will proceed on an individual basis.

4/ New Secondary Treatment Facility - not a system at this time.

5/ Those industries with waterborne wastes that will not be collected and treated in a municipal system, shall submit a preliminary report on their abatement program by January 1, 1969, shall submit final plans by October 1, 1969, shall start construction by April 1, 1970 and shall complete construction by June 1, 1971.

x Activity already accomplished.

APPENDIX C

The Federal Water Pollution Control Administration water quality survey of Lake Champlain was conducted during the period August 19-26, 1968. This survey consisted of a number of stations along the Vermont - New York State line with expanded grids in the vicinity of major tributaries and areas of waste discharges. One hundred and forty-five (145) samples were collected at 93 sampling stations. Eight stations were located in the Champlain Canal and 85 in Lake Champlain. At several stations, samples were taken from as many as three different depths. One sample only was collected at each sampling point.

Figures C-1 and C-2 present the location of each station while Table C-1 lists the results of the survey.

TABLE C-1

DATA, FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SURVEY OF LAKE CHAMPLAIN, AUGUST 1968

Station [1]	Water Temp °C	DO mg/l	Percent Sat.	BOD mg/l [2]	TOC mg/l [3]	Secchi Disc inches	Color Pt-Co Units	Total Solids mg/l	Total Alkalinity mg/l	T-N mg/l [4]	NO_3-N mg/l	PO_4 mg/l [5]	Total Coliform /100 ml [6]	Fecal Coliform /100 ml [6]
CC-194	20.5	7.7	84		4	18	60		5.5	.38	.23	.44	1,900	64
CC-200	21.5	7.9	90		4	18	30		3.0	.58	.14	.47	1,500	100
CC-205	21.5	7.8	89		6	7	50		21.8	.60	.28	.45	940	64
CC-209	21.8	7.1	80		6	6	60		21.8	.58	.23	.30	17,000	1,700
CC-214	21.8	7.4	84		4	6	60	120	42.0	.40	.31	.50	150,000	20,000
CC-217	21.7	7.3	83		7	6	80		57.5	.29	.20	.33	180,000	3,300
CC-219	22.0	6.8	77		9	6	60	138	59.1	.50	.21	.85	490,000	7,200
CC-220	22.0	7.2	82		11	6	60	115	66.0	.53	.21	.53	110,000	7,500
LC-0	22.0	6.7	76		4	6	60	110	66.0	.38	.24	1.87	28,000	1,800
LC-3	22.0	7.4	84		4		40		77.0	.35	.14	.30	680	64
LC-7	22.0	6.8	77		4	6	30	127	79.0	.41	.14	.68	560	72
LC-10	21.4	6.7	75		5	6	40		80.0	.53	.16	.52	920	24
LC-13.5	21.0	8.0	89		5	18	30	150	84.5	.44	.08	.18	960	44
LC-18-S	21.0	7.7	86	1.1	4		30	143	88.5	.32	.07	.21	420	8
LC-18-D	21.0	7.7	86	1.0	5		30	154	88.5	.30	.07	.25	200	4
LC-18A	21.0	7.8	87		4	18	40	153	87.2	.38	.07	.28	2,100	24
LC-18B	21.0	8.2	91		7	18	40	129	91.0	.33	.07	.95	72	4
LC-20-S	21.5	4.7	54	1.6	6		60		86.5	.41	.07	.33	12,000	620
LC-20-D	21.5	5.6	64	1.7	7		60		87.2	.63	.08	.23	6,300	180
LC-20A	21.3	2.6	29	1.9	7		60	130	83.5	.42	.07	1.28	9,900	310
LC-20B	21.5	4.6	52	1.7	7	18	60	143	85.5	.42	.08	1.28	6,500	120
LC-20.5-S	21.5	4.2	48	1.8	7		60	146	85.5	.50	.07	.23	6,800	270
LC-20.5-D	21.5	3.7	42	2.2	7		60	147	86.5	.47	.08	.35	7,300	820
LC-20.5A	21.6	1.5	17	8.9	12	18	80	170	89.0	.50	.07	.30	320,000	11,000
LC-20.5B	22.2	4.5	51	1.4	7		50	153	86.5	.42	.08	.43	6,900	180
LC-21-S	22.5	4.0	46	1.2	7	18	60	108	83.0	.44	.07	.21	8,200	770
LC-21-D	22.0	1.4	16		8		50	149	88.0	.45	.08	.21	80,000	5,900
LC-21A	22.0	2.2	25	4.0	11	18	60	155	92.0	.43	.07	.25	53,000	3,100
LC-21B		3.2	36	1.9	7		60	90	84.0	.44	.08	.21	26,000	980
LC-22-S	21.8	4.5	51	1.7	8	18	60	125	91.0	.43	.08	.18	6,600	280
LC-22-D	21.5	4.5	51	1.6	10		60	125	81.0	.44	.09	1.15	8,200	420
LC-22A	22.3	3.1	35	2.6	8	12	60	133	81.0	.48	.09	.25	39,000	2,000
LC-22B	22.3	4.3	49	1.8	6	18	60	164	92.0	.53	.07	.25	4,800	180
LC-24-S	21.3	7.8	87		5	18	60		78.0	.38	.09	.50	84	4
LC-24-D	21.0	7.7	86		5		80		77.0	.33	.10	.25	36	12
LC-26-S	21.0	8.0	89		5	18	100	140	85.0	.30	.12	.38	64	4
LC-26-D	21.0	8.0	89		5		80	157	77.8	.29	.11	.18	44	4
LC-30-S	20.8	8.3	92		5	12	80		67.5	.29	.10	.43	40	4
LC-30-D	21.0	8.2	91		4		80		73.2	.24	.09	.17	8	4
LC-35-S	20.4	9.0	98		4	36	30	84	59.0	.23	.06	.15	56	8
LC-35-D	19.8	9.1	99		4		30	72	50.5	.28	.05	.15	110	4
LC-36-S	19.8	9.0	98		5	72	20	62	50.2	.45	.05	.19	220	4
LC-36-D	19.8	8.7	95		3		20	67	50.5	.25	.06	.13	240	4
LC-36A	19.8	9.0	98		4	72	20	53	50.2	.25	.07	.08	860	8
LC-36B	19.8	9.0	98		5	60	20	98	51.0	.60	.05	.17	2,000	24
LC-41-S	19.4	9.2	98		3	108	20	60	49.0	.30	.04	.10	290	4
LC-41-D	9.8	9.4	83		6		20	100	44.5	.35	.05	.48	560	4

TABLE C-1 (Cont'd.)

Station [1]	Water Temp °C	DO mg/l	Percent Sat.	BOD [2] mg/l	TOC [3] mg/l	Secchi Disc inches	Color Pt-Co Units	Total Solids mg/l	Total Alkalinity mg/l	T-N [4] mg/l	NO_3-N mg/l	PO_4 [5] mg/l	Total Coliform [6] /100 ml	Fecal Coliform [6] /100 ml
LC-46-S	18.8	9.0	96		3	120	20		48.0		.05	.10	1,200	76
LC-46-D	18.6	9.0	96		3		20		46.0	.50	.05	.22	1,700	210
LC-47-S	19.0	9.1	97		3	180	20		46.0	.50	.05	.08	420	4
LC-47-D	9.4	10.4	90		2		20		43.5	.75	.06	1.94	260	4
LC-47A	18.6	9.2	98		2		20		46.0	.60	.20	.05	250	4
LC-47B-S	19.5	9.3	99		3	150	20		49.0	.30	.05	.17	460	4
LC-47B-D	19.1	9.0	96		2		20		48.0	.30	.05	.48	420	4
LC-50	19.6	9.1	99		3	48	10		49.0	1.05	.05	.14	630	4
LC-53-S		9.3	101		2	144	10		46.5	.25	.05	.08	1,100	4
LC-53-D		8.9			4		10	58	49.0	.40	.06	.08	620	4
LC-59-S	18.6	9.4	100		3	168	10		47.0	.35	.17	.90	1,400	4
LC-59-D	11.4	9.9	90		3		20		46.0	.35	.05	.38	500	4
LC-59A	19.0	9.5	101		2	144	20	12	48.0	.35	.05	.17	360	4
LC-59B-S	17.8	9.4	99		2	168	20	13	47.0	.40	.06	.08	880	4
LC-59B-D	9.4	10.3	89		3		20	55	46.5	.30	.22	.10	520	4
LC-59C	18.8				3	120	20	5	44.5	.30	.05	.10	560	4
LC-65-S	18.6	9.1	97		3	192	20		47.0	.35	.03	.76	8	4
LC-65-D	9.4	10.2	88		2		20		44.0	.90	.21	.05	40	4
LC-72-S		9.2			3	144	30		46.5	.50	.04	.14	2,000	4
LC-72-D	9.2	9.9	85		4		30		42.5	.90	.21	.10	540	4
LC-77-S	18.7	9.1	97		2	144	30		44.0	.25	.04	.05	820	4
LC-77-D	9.6	9.8	87		2		30		47.2	.25	.20	.05	340	4
LC-77A	18.8	9.3	99		2		30		44.5	.35	.04	.05	380	4
LC-83-S	19.5	9.2	100		6	222	30	31	44.5	.80	.04	.77	330	4
LC-83-D	9.4	9.8	85		3		30	69	43.5	.75	.22	.08	660	4
LC-89-S	19.6	9.0	98		4	232	30		44.0	.60	.04	.05	540	4
LC-89-M	9.8	9.4	83		2		30		45.0	.30	.24	.05	440	4
LC-89-D	9.0	9.8	85		3		20		42.5	.75	.24	.62	520	4
LC-94-S	20.4	9.3	103		4	174	20	91		.25	.04	.08	240	4
LC-94-D	10.0	9.1	80		2		10		41.5	.30	.22	.10	720	4
LC-94A-S	19.5	9.2	100		6		20		46.5	1.65	.15	.60	220	4
LC-94A-D	10.8	9.0	81		4		30		47.0	.15	.22	.13	540	4
LC-102-S	19.8	9.0	100		3	210	30		45.0	.40	.04	.10	140	4
LC-102-D	20.8	9.0	101		4		20		44.0	.40	.04	.25	300	4
LC-102A	21.0	9.3	103		3		30		45.0	.45	.04	.13	88	4
LC-102B	21.0	9.4	104		4		30		43.0	.35	.04	.13	440	4
LC-102C	21.8	9.1	103		4		30		46.0	.30	.04	.10	16	4
LC-106-S	20.8	9.1	101		4	192	30	26	45.5	.50	.03	.10	40	4
LC-106-D	20.0	9.1	100		5		30	100	44.0	.35	.03	.08	340	4
LC-106A	20.5	9.5	104		5		30		46.5	.30	.04	.14	740	210
LCS-1-S	17.8	9.3	98		3	192	20		44.5	.25	.04	.05	2,300	32
LCS-1-D	10.8	9.2	83		2		20		47.2	.30	.19	.48	1,200	4
LCS-2-S	18.6	9.0	96		2	144	20		44.5	.45	.04	.13	4,000	190
LCS-2-D	10.2	9.6	85		2		20		46.8	.40	.20	.03	880	4
LCS-3-S	18.7	9.2	98		3	132	20		44.5	.40	.04	.03	580	8
LCS-3-D	15.8	8.6	86		2		20		45.0	.20	.08	.05	980	4
LCS-4	18.6	9.5	101		6	120	20		43.0	.25	.03	.10	560	4

TABLE C-1 (Cont'd.)

Station [1]	Water Temp °C	DO mg/l	Percent Sat.	BOD [2] mg/l	TOC [3] mg/l	Secchi Disc inches	Color Pt-Co Units	Total Solids mg/l	Total Alkalinity mg/l	T-N [4] mg/l	NO_3-N mg/l	PO_4 [5] mg/l	Total Coliform [6] /100 ml	Fecal Coliform [6] /100 ml
LCB-1-S	18.5	9.2	97		3	156	20	55	45.5	.15	.05	.17	1,200	4
LCB-1-M	14.6	8.7	85		3		20	31	45.0	.30	.12	.08	1,200	4
LCB-1-D	8.8	9.9	86		3		20	20	45.0	.30	.21	.29	600	4
LCB-2-S	18.4	9.1	96		3	144	30	37	45.0	.55	.04	.14	880	4
LCB-2-D	9.2	10.2	88		3		20	46	46.0	1.05	.04	.14	440	4
LCB-3-S	18.5	9.3	98		3	156	20	93	45.0	.40	.04	.48	1,300	4
LCB-3-D	18.4	9.3	98		3		20	52	42.0	.40	.04	.10	1,500	4
LCB-4-S	18.6	9.2	98		3	144	20	91	46.0	.80	.04	.05	780	8
LCB-4-D	17.8	8.6	90		3		20	27	44.2	2.05	.05	.10	840	12
LCB-5-S	18.2	9.0	96		4	168	20	35	45.5	.25	.03	.03	3,300	48
LCB-5-D	18.6	9.2	97		4		20	33	46.0	.35	.04	.13	720	16
LCW-1-S	18.5	9.4	99		4	144	30		45.5	.35	.05	.08	420	4
LCW-1-D	8.4	10.3	87		4		30		45.5	.55	.23	.08	260	4
LCW-2	18.4	9.5	100		2	132	30		44.2	.45	.04	.05	620	4
LCA-1-S	18.7	9.5	101		3	150	30		47.5	.75	.04	.10	560	4
LCA-1-D	18.5	9.3	98		4		30		47.5	.85	.04	.05	2,700	4
LCA-2	18.4	9.5	100		7	138	30		46.0	.25	.04	.13	1,300	4
LCA-3	18.5	9.2	97		3	144	20		49.0	.25	.05	.22	1,400	4
LCA-4-S	18.5	9.4	99		2	138	30		43.0	.25	.04	.05	2,000	4
LCA-4-D	14.8	8.3	81		4		30		45.5	.20	.13	.03	2,200	4
LCC-1-S	18.8	9.2	98		3	180	30	74	45.5	.90	.10	.08	1,100	4
LCC-1-D	10.5	9.7	86		4		30	95	42.5	.40	.22	.25	720	4
LCC-2-S	19.2	9.1	97		2		30	75	47.0	.65	.04	.13	560	4
LCC-2-D	18.7	8.9	95		4		30	85	45.0	.40	.04	.05	1,200	8
LCC-3	19.2	5.8	62		13	36	40	58	44.5	.35	.07	.17	20,000	3,800
LCC-4	18.8	9.1	97		3		30	105	44.5	.65	.04	.03	1,200	130
LCV-1-S	21.2	9.1	102		4	156	30		32.5	.40	.03	.08	60	4
LCV-1-D	19.8	9.2	100		7		30		36.0	.30	.04	.22	180	4
LCV-2-S	21.0	9.0	100		5	120	30	69	29.5	.25	.04	.34	320	4
LCV-2-D	20.8	9.1	101		4		30	78	32.0	.20	.04	.13	620	4
LCV-3-S	20.7	9.2	101		3	156	30		34.0	.55	.04	.19	120	4
LCV-3-D	19.8	9.1	99		3		30		32.0	1.30	.04	.10	170	4
LCV-4-S	20.7	9.1	100		2	156	20	80	35.5	.30	.03	.08	400	4
LCV-4-M	17.5	6.0	62		2		20	93	36.5	.25	.06	.05	1,600	4
LCV-4-D	14.6	5.1	50		2		20	91	34.5	.30	.12	1.19	1,200	4
LCV-5	20.5	9.0	99		4		20			.30			780	4
LCV-6-S	20.0	8.9	97		2	198	20	90	33.2	.30	.03	.05	660	4
LCV-6-D	20.0	9.0	98		2		20	91	37.0	.40	.04	.64	700	4
LCV-7-S	20.8	9.2	102		3	180	20	93	35.5	.45	.03	.10	160	4
LCV-7-D	20.2	8.4	92		2		20	85	32.5	.30	.03	.10	96	4
LCV-8	21.5	9.4	105		4	120	20	83	35.5	.50	.04	.25	270	4
LCV-9	21.8	9.3	105		2	180	20	87	36.0	.35	.04	.13	150	4
LCV-10-S	20.4	9.1	100		4	180	20		34.2	.60	.03	.37	740	4
LCV-10-D	20.0	8.7	95		3		20		37.0	.90	.03	.10	800	4

TABLE C-1 (Cont'd.)

Station 1/	Water Temp °C	DO mg/l	Percent Sat.	BOD 2/ mg/l	TOC 3/ mg/l	Secchi Disc inches	Color Pt-Co Units	Total Solids mg/l	Total Alkalinity mg/l	T-N 4/ mg/l	NO_3-N mg/l	PO_4 5/ mg/l	Total Coliform 6/ /100 ml	Fecal Coliform 6/ /100 ml
LCV-11-S	21.0	9.2	102		2	150	20			.70	.05	.08	110	4
LCV-11-D	19.6	8.1	88		3		20			.75	.03	.13	1,200	4
LCV-12	20.5	9.2	101		3	144	20	93		.60	.05	.05	440	4
LCV-13-S	21.7	9.3	105		2	180	20		35.5	.30	.04	.08	400	4
LCV-13-D	15.5	5.2	51		2		20		36.5	.40	.11	.32	1,300	4
LCD-1-S	20.0	9.3	101		4	138	20		46.2	.35	.05	.08	1,000	4
LCD-1-D	19.0	9.4	100		3		20		47.0	.80	.04	1.08	290	4

1/ See Figures C-1 and C-2 for sampling station locations.
2/ BOD: 5 day 20°C Biochemical Oxygen Demand, 100 percent dilution.
3/ TOC: Total Organic Carbon.
4/ Total Nitrogen as Nitrogen as measured by Auto-Analyzer.
5/ Total Phosphate as PO_4
6/ Total and Fecal Coliform measured by membrane filter (MF).

S - Surface Stations - taken five feet from water surface.
M - Mid Stations - taken in the thermocline where stratification occurred.
D - Deep Stations - taken five feet from bottom where no stratification occurred. Taken within the hypolimnion where stratification was present.
CC - Stations in Champlain Canal.
LC - Stations in Lake Champlain.
LCS - Stations in Shelburne Bay.
LCB - Stations in Burlington Bay.
LCW - Stations near Winooski River.
LCA - Stations near Ausable River.
LCC - Stations in Cumberland Bay.
LCV - Stations in Northeast Arm.
LCD - Stations in Deep Bay.

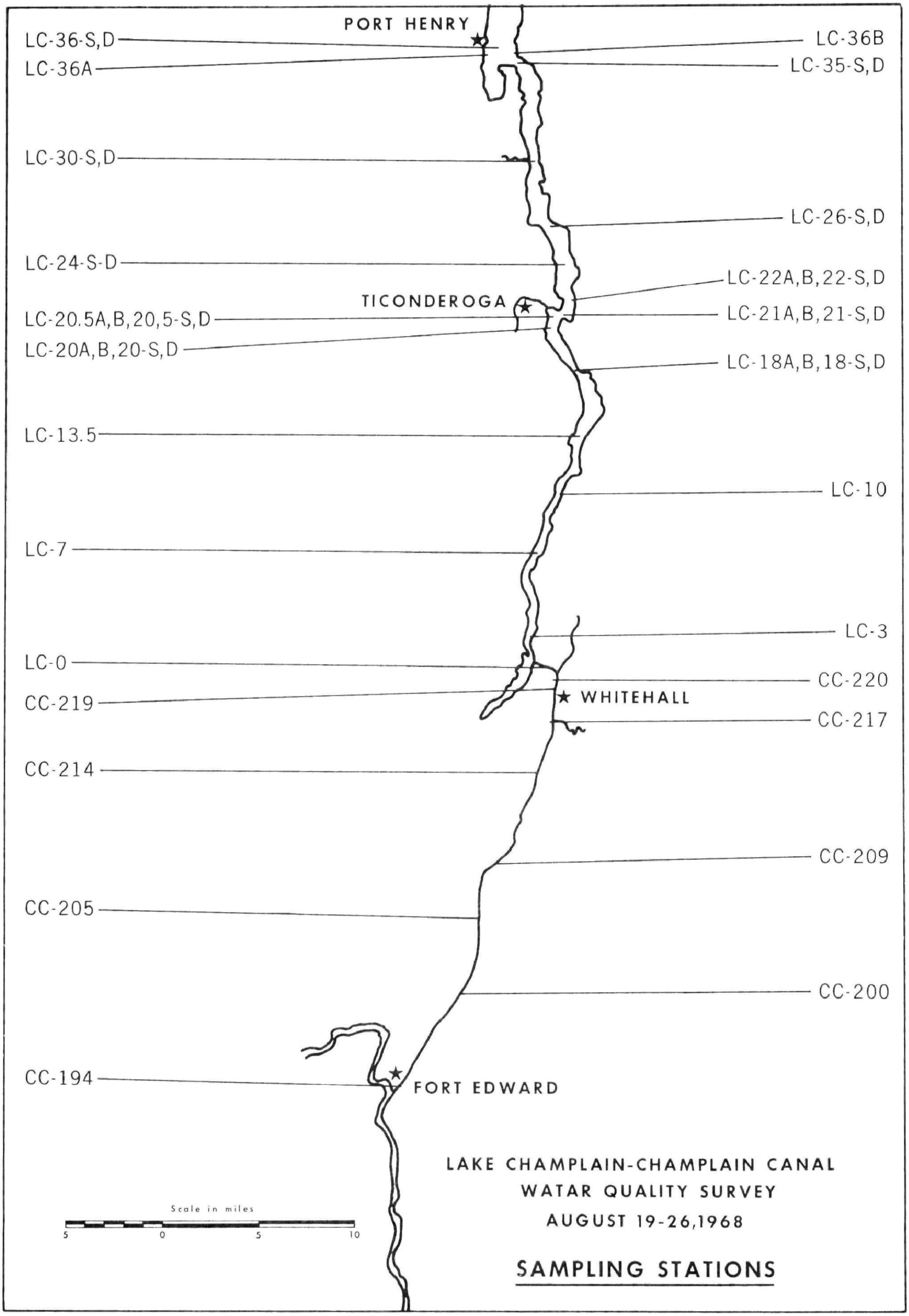
PORT HENRY
LC-36-S,D
LC-36A
LC-36B
LC-35-S,D
LC-30-S,D
LC-26-S,D
LC-24-S-D
LC-22A,B,22-S,D
TICONDEROGA
LC-20.5A,B,20,5-S,D
LC-21A,B,21-S,D
LC-20A,B,20-S,D
LC-18A,B,18-S,D
LC-13.5
LC-10
LC-7
LC-3
LC-0
CC-220
CC-219
WHITEHALL
CC-217
CC-214
CC-209
CC-205
CC-200
CC-194
FORT EDWARD
LAKE CHAMPLAIN-CHAMPLAIN CANAL
WATAR QUALITY SURVEY
AUGUST 19-26,1968
SAMPLING STATIONS
Scale in miles
5
0
5
10

Figure C-1

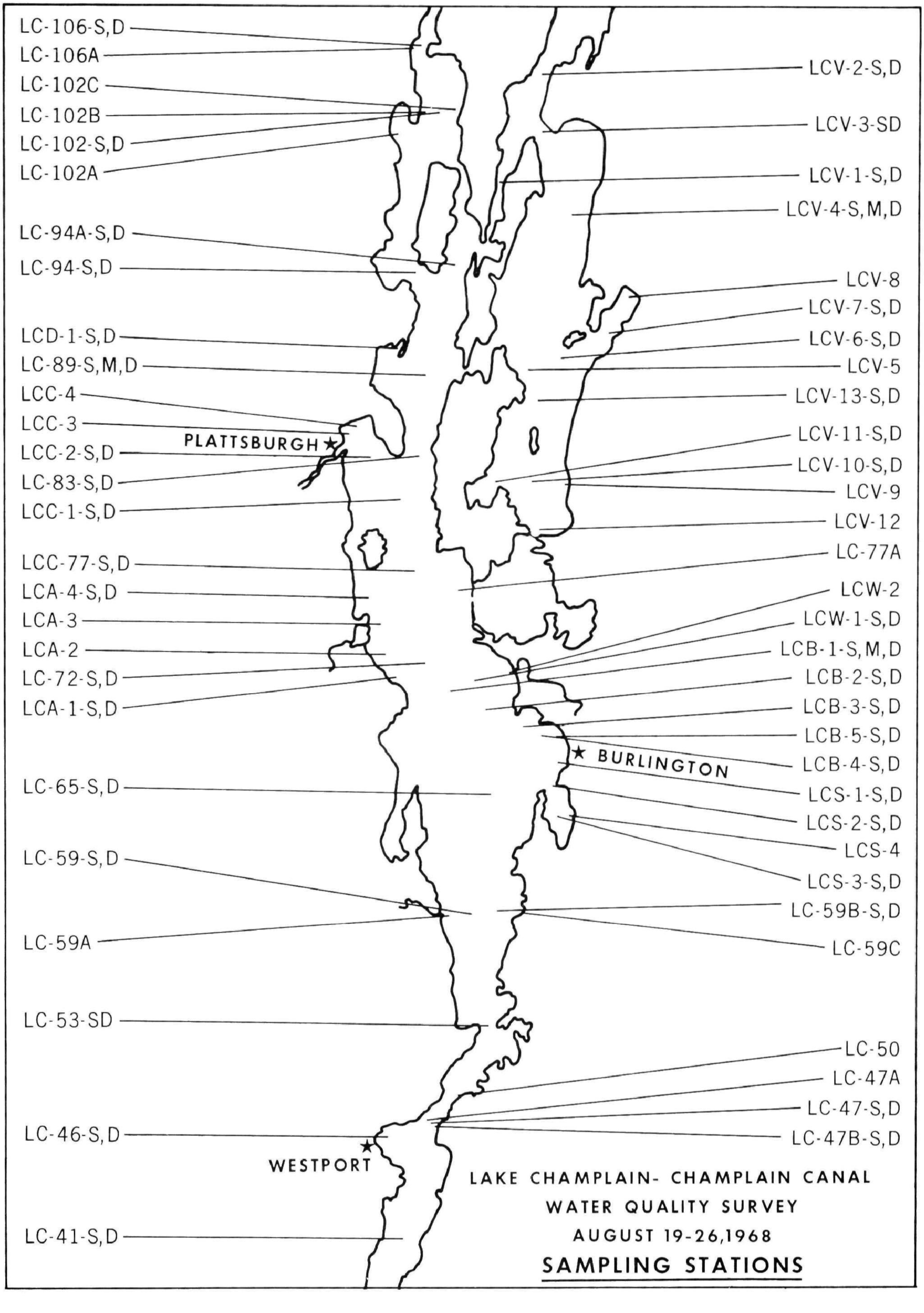
LC-106-S,D
LC-106A
LC-102C
LC-102B
LC-102-S,D
LC-102A
LC-94A-S,D
LC-94-S,D
LCD-1-S,D
LC-89-S,M,D
LCC-4
LCC-3
PLATTSBURGH
LCC-2-S,D
LC-83-S,D
LCC-1-S,D
LCC-77-S,D
LCA-4-S,D
LCA-3
LCA-2
LC-72-S,D
LCA-1-S,D
LC-65-S,D
LC-59-S,D
LC-59A
LC-53-SD
LC-46-S,D
WESTPORT
LC-41-S,D
LCV-2-S,D
LCV-3-SD
LCV-1-S,D
LCV-4-S,M,D
LCV-8
LCV-7-S,D
LCV-6-S,D
LCV-5
LCV-13-S,D
LCV-11-S,D
LCV-10-S,D
LCV-9
LCV-12
LC-77A
LCW-2
LCW-1-S,D
LCB-1-S,M,D
LCB-2-S,D
LCB-3-S,D
LCB-5-S,D
BURLINGTON
LCB-4-S,D
LCS-1-S,D
LCS-2-S,D
LCS-4
LCS-3-S,D
LC-59B-S,D
LC-59C
LC-50
LC-47A
LC-47-S,D
LC-47B-S,D
LAKE CHAMPLAIN- CHAMPLAIN CANAL
WATER QUALITY SURVEY
AUGUST 19-26,1968
SAMPLING STATIONS

Figure C-2

GLOSSARY OF WATER POLLUTION TERMS

Biochemical Oxygen Demand (BOD) - the amount of oxygen required by living organisms while decomposing organic matter in the presence of oxygen as measured by the 5-day 20°C BOD test.

Population Equivalent (PE) - the pollutional effect of various waste discharges expressed in terms of a corresponding effect of discharging raw sewage from an equivalent number of human population. Based on the ratio of pollutional matter (expressed in terms of BOD) to the per capita amount of the same pollutional matter normally found in domestic sewage. For example:

$$PE = \frac{\text{\# BOD of waste per day}}{.17 \text{ \# BOD of domestic waste per capita per day}}$$

Primary Treatment - the physical removal of floatable and settleable solids, and BOD from municipal and industrial wastes. Treatment consisting of primary settling and skimming can generally remove 25-30 percent of the BOD, 45-65 percent of the total suspended matter, and substantially all floatable and settleable material.

Secondary Treatment - the treatment of organic wastes by primary treatment followed by a biological process and secondary settling. Secondary treatment can generally remove 80-95 percent of the BOD and suspended matter, and substantially all floatable and settleable material.

Save-all - an industrial treatment process (sedimentation, flotation or filtration) used to recover fibers.

Thermocline - A layer of water in a thermally stratified lake separating an upper, warmer, lighter zone from a lower, colder, heavier zone.

Epilimnion - the layer of water above the Thermocline in a fresh water lake or pool.

Hypolimnion - the layer of water below the Thermocline in a fresh water lake or pool.

GLOSSARY OF WATER POLLUTION TERMS

Biochemical Oxygen Demand (BOD) - the amount of oxygen required by living organisms while decomposing organic matter in the presence of oxygen as measured by the 5 day $20^{o}C$ BOD test.

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$$PE = \frac{\text{\# BOD of waste per day}}{\text{.17 \# BOD of domestic waste per capita per day}}$$

Primary Treatment - the physical removal of settleable solids and BOD from municipal and industrial wastes. Treatment consisting of primary settling can generally remove 25 to 35 percent of the BOD and 45-65 percent of the total suspended matter.

Secondary Treatment - the removal of organic wastes beyond that possible by primary treatment only. Treatment consists of primary settling followed by a biological process and secondary settling. Secondary treatment can generally remove 80-95 percent of the BOD and suspended matter.

Save-all - an industrial treatment process (sedimentation, flotation or filtration) used to recover fibers.

Thermocline - a vertical temperature gradient in some layer of a body of water, which is appreciably greater than the gradients above and below it.

Epilimnion - the layer of water above the Thermocline in a fresh water lake or pool.

Hypolimnion - the layer of water below the Thermocline in a fresh water lake or pool.