INTERNATIONAL
JOINT COMMISSION

THE UNITED STATES AND CANADA

1973
SECOND ANNUAL REPORT ON

Great Lakes Water Quality

INTERNATIONAL JOINT COMMISSION

To the Government of Canada
Government of the United States
Government of the State of Illinois
Government of the State of Indiana
Government of the State of Michigan
Government of the State of Minnesota
Government of the State of New York
Government of the State of Ohio
Government of the State of Pennsylvania
Government of the State of Wisconsin
Government of the Province of Ontario

Gentlemen:

The International Joint Commission (IJC) appreciates this opportunity to report to you on the progress which has been achieved during the calendar year 1973 and part of 1974 toward implementing programs and achieving the objectives set forth in the Great Lakes Water Quality Agreement of April 15, 1972.

In collecting, collating and assessing the large amount of data and information necessary to produce this report, the Commission has had the valued assistance of all the Governments concerned and several hundreds of their technical experts, and members of the joint institutions established by the IJC pursuant to the Agreement. This cooperation is greatly appreciated.

It is the Commission's view that while a great deal of progress has been achieved in both countries toward implementing the Agreement, the task as envisaged by Government is just beginning. It will take increased effort on the part of all concerned to achieve the complex of objectives in the Agreement. We look forward to your continuing cooperation and effort in what is obviously an immense undertaking.

Christian A. Herter, Jr. United States Chairman
Maxwell Cohen, Q.C., Canadian Chairman
Charles R. Ross
Bernard Beaupre
Keith A. Henry
Victor L. Smith

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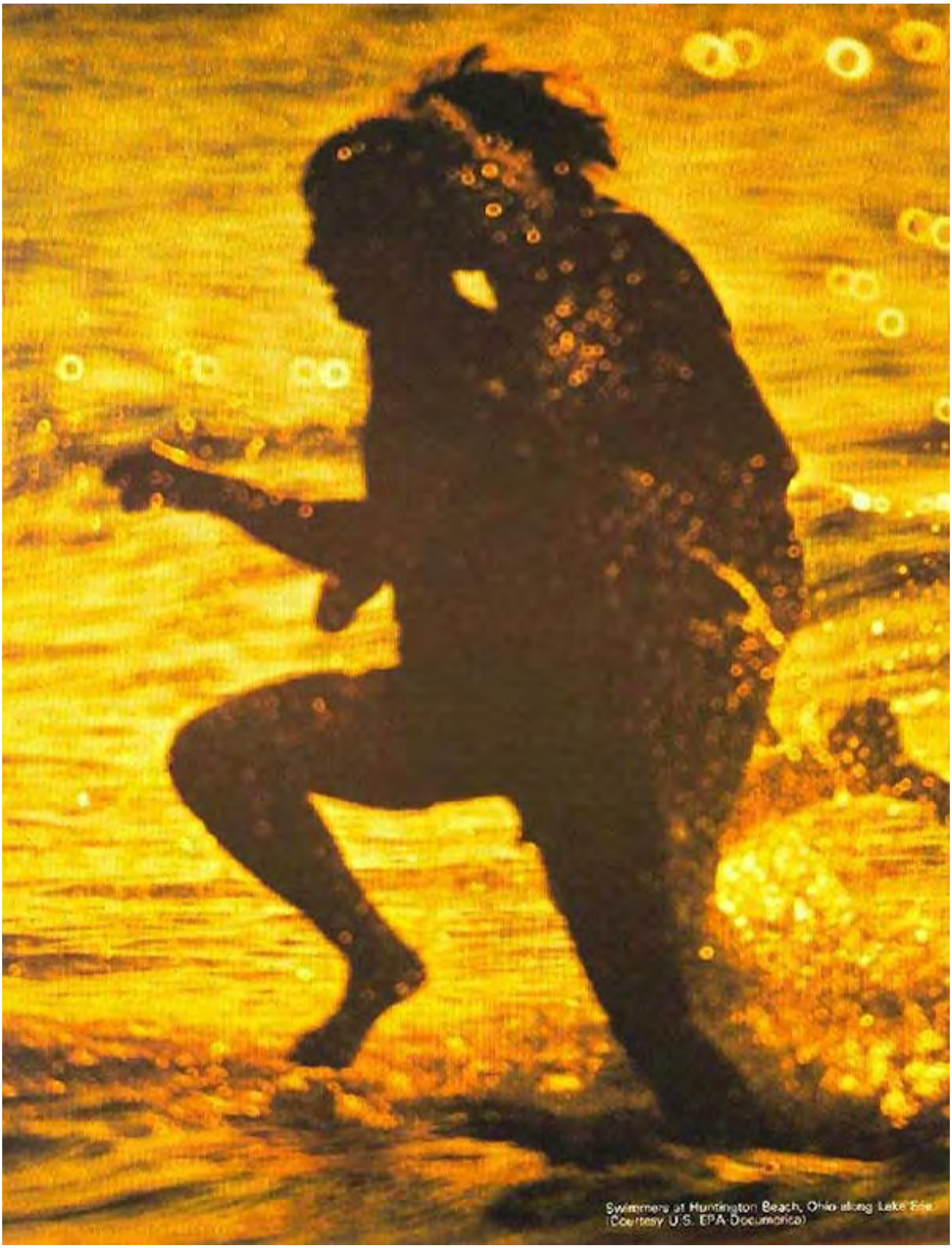


Swimmers at Huntington Beach, Ohio along Lake Erie
(Courtesy U.S. EPA Documerica)

CHAPTER I
INTRODUCTION AND SUMMARY

This is the second Annual Report of the International Joint Commission concerning progress toward the achievement of the water quality objectives which the Governments of the United States and Canada adopted in the Great Lakes Water Quality Agreement. That Agreement was signed April 15, 1972, on behalf of their respective Governments by the President of the United States and the Prime Minister of Canada. The Commission's first report to the Parties and to the State and Provincial Governments was based primarily on 1972 conditions, but also reflected significant developments through mid 1973. The present report similarly covers progress during 1973 and takes cognizance of developments in the early months of 1974.

The Commission in April received the second annual report of its Great Lakes Water Quality Board and transmitted it to the Canadian and United States Governments. Copies of the report are available from the Commission on request until present supplies are exhausted or may be purchased directly from the National Technical Information Service, Springfield, Virginia.

In the present report the Commission draws attention of the Governments to only the most significant aspects of the Water Quality Board's report and sets forth its own conclusions and recommendations. This report also reflects information and advice received from the Commission's Research Advisory Board relating to research activities in Canada and the United States concerning the quality of the waters of the Great Lakes System; from the International Reference Group on Great Lakes Pollution from Land Use Activities relating to its on-going studies on behalf of the Commission; and from the International Reference Group on Upper Lakes Pollution relating to its studies of actions needed to preserve and enhance the water quality of Lake Superior and Lake Huron.

While there are many indications and suggestions that the quality of the Great Lakes water is improving as a result of the remedial programs and other measures undertaken in accordance with the 1972 Agreement, the progress toward meeting the agreed objectives cannot yet be confirmed on the basis of the scientific data and information supplied to the Commission. Aside from the difficulties of collecting water quality data on such immense bodies of water under variable natural conditions, the sampling and analytical procedures employed in the several jurisdictions are not consistent and as a result the data made available from these sources is not comparable and does not lend itself to "collation, analysis and dissemination" by the Commission. Moreover, insufficient resources of qualified personnel have been assigned by the government agencies to assessment and interpretation of the basic data obtained. The Water Quality Board is now endeavouring to develop the basis for the necessary coordination of the agencies' monitoring programs so that over-all water quality and trends in the Basin may be assessed on a continuing basis.

Presque Isle beach at Erie, Pennsylvania.
(Courtesy U.S. Corps of Engineers, Buffalo District)

Although scientific confirmation of improved water quality is lacking, there is no doubt that substantial progress in meeting the overall problem is in fact taking place; despite the increase in population and economic activity in the Basin, conditions appear not to have worsened since 1972. More communities are being served by sewers, more sewage treatment plants are being built, more sewage receives adequate treatment and more industries are treating their wastes before discharge. Long time observers and users of the lakes remark on the increased clarity of the waters in certain areas.

Progress is being made in providing municipal sewage treatment facilities considered by the control agencies to be adequate to meet the agreed water quality objectives. In 1971 an estimated 80 percent of the sewered population in the Canadian portion of the Basin and an estimated 5 percent of the sewered population in the United States portion (excluding Chicago) was served by "adequate" treatment facilities. By December 31, 1975, these percentages are expected to increase to 98 percent in Canada and 60 percent in the United States. Forty-seven U.S. projects scheduled for completion in the period 1976-78 and to serve a

population of some five millions are expected to bring the U.S. figure to 95 percent of its sewered population. In this connection it must be noted that we are speaking here of only the populations served by sewers. There are presently almost two million persons in the Canadian portion and over five millions in the U.S. portion of the Basin (approximately 25 percent) who have no sewers.

Apparently the impoundment, by the Executive Branch of the United States Government, of half of the $18 billion appropriated by Congress has not as yet delayed the construction of municipal treatment facilities in the U.S. portion of the Basin. As of July, 1974, an estimated $1,125 million of the funds allocated to the Great Lakes Basin States has been made available for that purpose. There is no doubt, however, that the procedural requirements of the U.S. legislation and regulations have been a major cause of delays in awarding municipal construction grants and may explain in part the availability of these funds. The Commission continues to be concerned that the 50 percent reduction in available funds will cause unnecessary delays in completion of urgently needed projects. As the procedural delays disappear, the grant program activity will increase. Table 2 of the report lists major municipal treatment facilities which will not be completed until after December 31, 1975.

The National Pollutant Discharge Elimination System (NPDES) Permit Program in the United States is expected to develop eventually into an effective program for the measurement and control of pollution from industrial sources. Only a small number of permits had been granted as of December, 1973, but all industries discharging wastes directly must obtain permits by the end of this year. Final compliance dates are specified in each permit, but it is expected that many of them will be well beyond December, 1975. Consequently, it is too early for the Commission to assess the impact of the NPDES permit program on the control of industrial pollution in the Great Lakes Basin.

The two major investigations which the Governments requested the Commission to undertake at the time the 1972 Agreement was signed are being carried out respectively by the Reference Group on Great Lakes Pollution from Land Use Activities and the Reference Group on Upper Lakes Pollution, under the general supervision of the Great Lakes Water Quality Board. Detailed study plans have been approved by the Commission and both investigations are proceeding on schedule. The Water Quality Board and the Research Advisory Board are functioning with increasing effectiveness as the principal advisor to the Commission in their respective fields.

The Commission's recommendations to the Governments appear in the final chapter of this report.

Wisconsin pulp and paper plant. (Courtesy U.S. EPA-Documerica)

CHAPTER II
WATER QUALITY ASSESSMENT

The International Joint Commission is required under the 1972 United States-Canada Water Quality Agreement to report "no less frequently than annually" on progress toward meeting the objectives established under the Agreement. In its first annual report last year (1973), the Commission stated it could not report adequately on progress, or lack of it. Although there are many indications of improving water quality, the Commission cannot report progress or the lack of it, with scientific accuracy. There are several specific reasons for this situation, including;

- the lack of systematic quality control programs in the eleven jurisdictions concerned in the Great Lakes Basin;
- the non-comparability of data and the absence of sampling data that is statistically valid;
- the lack of adequate staffing at all levels to carry out water quality assessment;
- the lack of specific objectives for many water pollutants; and
- the variable conditions, unpredictable natural processes and vast size of the Great Lakes System.

The 1972 Agreement set forth many water quality objectives toward which the U.S. and Canada have been working. Eventually the water is to be free of substances (resulting from human activity) that will harm or adversely affect human, animal, or aquatic life, including water fowl; from objectionable sludge deposits, and from materials that float in unsightly or large amounts, produce nuisance levels of color or odor, or create nuisance growths of algae or aquatic weeds.

Specific objectives were established by the Agreement for coliform bacteria, dissolved oxygen (DO), total dissolved solids (TDS), iron and pH. Additionally, the Agreement provided that phenols and other taste- and odor-producing materials should be essentially absent, phosphorus should be limited as necessary to prevent nuisance algae growths, weeds and slime, and radioactivity should be controlled to prevent harmful effects on health.

By contrast, interim objectives prescribed that no harmful amounts of heat, mercury and other toxic substances, settleable and suspended materials and oil or other floating materials should be discharged to the lakes. These objectives are to be in effect until they are further delineated. In this regard, the Commission's Water Quality Board and Research Advisory Board, established under the terms of the Agreement, have begun to develop recommendations on refined and new specific water quality objectives for consideration by the Commission and ultimately the two Governments.

The Commission has not yet been able to assess compliance with Article IV of the Agreement, which requires that water quality standards and other regulatory requirements of the Governments shall be consistent with the achievement of the water quality objectives. Specific problems in evaluating data exist because different parameters are measured, different sampling and laboratory methods are used, and different levels of effort are applied to data evaluation and analysis by each of the jurisdictions concerned. There is a need for a coordinated overall monitoring program which specifies sampling locations, frequencies, procedures, and early-warning capabilities; the use of standard methods for field or laboratory analyses of the samples; systematic analytical quality control programs and conformance in data storage, retrieval, verification, analysis, and utilization. The Water Quality Board is now developing the basis for such a coordinated program in order to assess in the future, with scientific assurance, progress in achieving the agreed water quality objectives.

There is at present a lack of adequate staffing at all levels of government to evaluate and interpret the data being collected. Experience shows that people and funds have been available for the collection of water quality data. By contrast, sufficient personnel and financial resources have not been made available to summarize, validate, evaluate and fully utilize this data. For example, a major contribution to Lake Erie pollution is the discharge of municipal and industrial wastes into and from the 30 mile-long Detroit River. Volumes of data have been accumulated in recent years as the result of extensive monitoring and sampling programs by federal, state and provincial governments. Yet authorities responsible for monitoring water quality in this, the most thoroughly studied reach of the Great Lakes System, assert that to date, no analysis has been made of the year-to-year changes in concentrations of pollutants, nor has it been determined what effects varying flow rates (dilution) have on them.

Procedures for the Submission and Exchange of Information were developed by the Great Lakes Water Quality Board, and, after consultation with the Governments, were duly established by the Commission in accordance with the Agreement. They have not been closely adhered to by the responsible agencies. Such adherence, supported by adequate funds and personnel allocations, is essential to enable the Commission to provide, as directed by the Agreement, an assessment of the progress being made towards achievement of the agreed water quality objectives.

Even if all the difficulties referred to above were to be overcome, a scientifically accurate assessment of the water quality of the Great Lakes would be a difficult and complex undertaking because of the vastness and constantly changing conditions of the system. For example, Lake Erie, the most studied of the Great Lakes,

is a dynamic, living resource in which water quality, over short and long periods, changes in ways which are difficult to measure. Average yearly inflow to this smallest of the lakes is approximately one-fourth of its volume. However, because of mixing and stirring by wind and current patterns, it would take six to seven years to flush 90% of a dissolved salt from the lake. In addition, design, construction, and start-up of major sewage treatment plants often requires five years; even more time passes before a plant's effectiveness can be measured. All these factors combine so that a comparison of water quality data this year with what it was one, two or three years ago is difficult to make.

This situation leads the Commission to conclude that despite the acquisition of large amounts of raw water quality data from the Great Lakes, it is not possible to say with scientific assurance that Lake Erie in 1973 was worse, the same or better than it was in 1970. Some measurements showed improvement while others showed worse conditions. The best that can be said is that degradation of Lake Erie appears to have been halted.

Notwithstanding the lack of specific scientific proof, the Commission is satisfied that actions are being taken on both sides of the border that should lead to improved water quality. More communities throughout the basin are sewered; plants are being built with a higher level of sewage treatment than existed before, and, therefore, more sewage receives adequate treatment; more industries are pretreating their wastes.

In addition, there are reports from people who have resided near the lakes for many years and have utilized its resources in business and recreational pursuits, that lake waters, especially in localized areas, appear to be improving. Such improvement is being reported with increasing frequency in newspapers, magazines and TV reports throughout the Basin. It can be assumed that these reports cover only a small portion of the observations made by the hundreds of thousands of people who view the lakes each day.

Commercial fishing in Black Bay, Ontario on Lake Superior. (Courtesy Ontario Ministry of Natural Resources)

Restocking lake trout in Sudbury District of Ontario. (Courtesy Ontario Ministry of Natural Resources)

One test of water quality is the changing characteristics of the fish population. A frequent comment heard is that fishing opportunities are improving. This is partially because of the successful efforts to stock brown trout and coho salmon. Such success points to improved water quality since the brown trout is a species particularly sensitive to pollutants.

Improvement in water quality in lakes Michigan and St. Clair has been evidenced by recent analysis of various species of fish for mercury, DDT and polychlorinated biphenyl (PCB) levels. These analyses, conducted by the Great Lakes Fishery Laboratory of the U.S. Department of the interior, show decreases in the concentrations of these contaminants. The actions of the Province of Ontario and the State of Michigan in prohibiting the discharge of mercury from chlor-alkali plants have resulted in a drop of 60 percent in mercury levels in rock bass and yellow perch in Lake St. Clair since 1970. This is particularly encouraging in view of the critical situation which existed prior to 1971. A decline from nearly 10 parts per million (PPM) to less than 5 PPM in the level of DDT in chub taken from Lake Michigan has also occured since 1970. Some decline has been observed in the DDT levels of Lake Michigan lake trout and salmon. These declines may be attributed to actions in both countries controlling the use of DDT. The PCB contamination level does not appear to have declined in the flesh of shad, carp and pike taken from the watershed of Saginaw Bay on Lake Huron between 1971 and August 1973.

Other indicators of progress are the reduction in phytoplankton and total coliform bacteria counts recorded at selected water works intakes along the Ohio shores of Lake Erie, and reductions in phosphorus loadings throughout the Great Lakes Basin. The latter subject is covered in greater detail in Chapter III of this report.

CHAPTER III
PROGRAMS, PROGRESS AND PROBLEMS

Introduction

With the signing of the 1972 Agreement the Governments adopted certain specified water quality objectives and committed themselves to make progress towards achieving them. They also agreed that programs and other measures to meet those objectives would be developed and implemented as soon as practicable and would be either completed or in the process of implementation by December 31, 1975.

Many of the programs and activities required under the Great Lakes Water Quality Agreement were underway to some degree in 1972 when the Agreement was signed. These include municipal sewage treatment plant construction grant programs, dredge spoil disposal research, combined sewer studies, land drainage research, and other activities described in the following pages. The Agreement has served to enlarge and intensify these programs in order to meet agreed-to objectives.

Problems in the implementation of the Agreement have arisen, particularly in the United States, because of bureaucratic delays in actually funding the construction of municipal sewage treatment works, and procedural complexities created by Congressional amendments to the Federal Water Pollution Control Act (PL 92-500). Only now (July 1974) are these constraints being overcome in some measure by the U.S. Environmental Protection Agency (EPA), with the release of greater amounts of construction grants to the States ($200 million in June 1974) and simplification of grant application procedures.

Municipal wastewater treatment, however, is only part of the problem. At present little is known about the pollution impact of unsewered populations, the local and larger effects of agricultural land drainage and their relationship to eutrophication, and other factors. The studies being carried out by the reference groups on Pollution from Land Use Activities and Pollution of the Upper Lakes are designed to fill these data gaps.

Municipal Wastewater Treatment

The Water Quality Board has assessed progress in implementing municipal wastewater treatment programs on the basis of the percentage of the population in each jurisdiction served by a municipal sewage collection system which discharges to a treatment plant providing a level of treatment considered adequate to ensure achievement of the water quality objectives for the Great Lakes.

Present assessment of progress is based on the definitions of "adequate" used by the United States and Province of Ontario. In the U.S., adequate treatment is defined by legislation as a minimum of secondary treatment with 85 percent removal of biochemical oxygen demand (BOD) and suspended solids (SS) disinfection, and a total phosphorus reduction of 80 percent which normally produces an effluent phosphorus of 0.5 to 1.0 mg/L. This requirement applies on a national basis. In Ontario, which embraces the entire Canadian shoreline of the Great Lakes, adequate treatment is defined on the basis of an assessment of the impact of the waste discharge on the receiving water. Generally, a minimum of secondary treatment or equivalent is required, which provides 20 mg/L of BOD and SS in the effluent. Phosphorus reduction to 1.0 mg/L P or less by 1975 is required in the lower lakes basin.

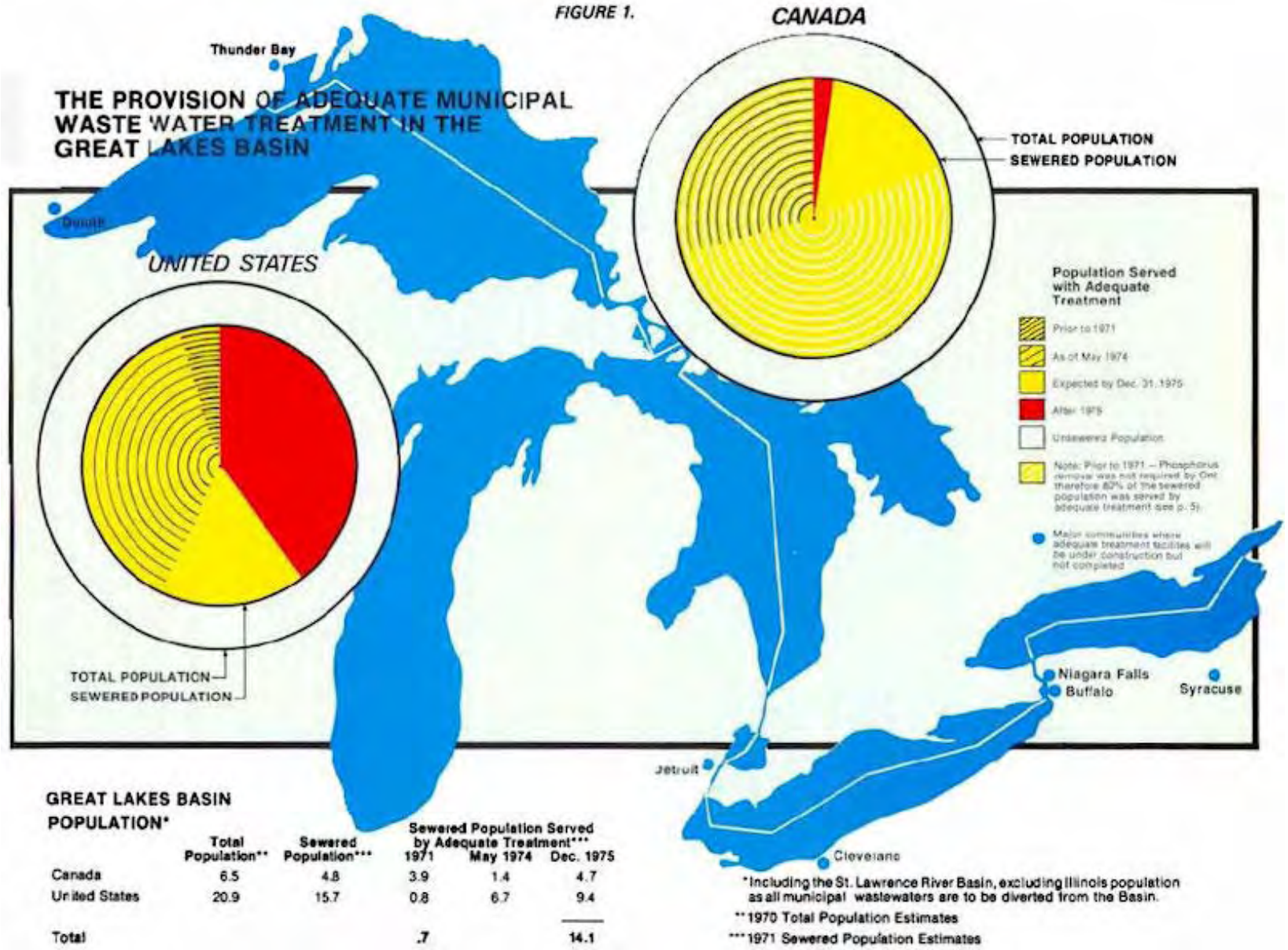
It is important to recognize that progress stated relates only to sewered population. There are 6.9 million people in the Great Lakes Basin (25 percent of the total basin population) who have no sewers; 5.2 million in the U.S., 1.7 million in Canada. Their contribution to the pollution loads of the lakes are presently unknown; however, the Pollution from Land Use Activities Reference Group studies now underway should provide baseline information.

Using the 1971 sewered population figures as a basis for comparison, progress of Ontario and the eight Great Lakes States in providing adequate sewage treatment facilities assessed as of May 1974 and forecast for December 31, 1975, is shown in Figure 1.

In Ontario the municipal waste treatment program was well underway prior to the signing of the Agreement. In 1971 nearly four million persons, which represents about 80 percent of the sewered population in Ontario, were considered to be served by adequate treatment. At that time, the definition of adequate treatment did not include the requirement for phosphorus removal facilities in wastewater treatment plants in the lower lakes basin, a requirement which was later established with the signing of the Agreement. However, as of May 1974, phosphorus removal facilities were essentially completed in treatment plants in the Lake Erie Basin, but not in the Lake Ontario Basin. By 1975, it is estimated that the wastes from 98 percent of the sewered population in Ontario will be adequately treated, including phosphorus removal.

On the U.S. side a major program, particularly with respect to larger municipalities discharging directly to the Great Lakes, was needed. Prior to 1971, it is estimated that only 5 percent of the 15.7 million sewered population in the Great Lakes States were served by adequate treatment facilities. This figure does not include Chicago because its sewage is being diverted out of the Basin. The assessment of May 1974 was that adequate treatment was being provided for 6.7 million persons (42 percent). By the end of 1975, it is anticipated that this will increase to 60 percent or 9.5 million persons. An additional

FIGURE 1.



GREAT LAKES BASIN POPULATION*

	Total Population**	Sewered Population***	Sewered Population Served by Adequate Treatment*** 1971	May 1974	Dec. 1975
Canada	6.5	4.8	3.9	1.4	4.7
United States	20.9	15.7	0.8	6.7	9.4
Total			.7		14.1

*Including the St. Lawrence River Basin, excluding Illinois population as all municipal wastewaters are to be diverted from the Basin.

**1970 Total Population Estimates

***1971 Sewered Population Estimates

TABLE 1. U.S. FEDERAL FUNDING UNDER PL92-500

	Appropriated	Impounded	Available	Allocated to the Eight Great Lakes Basin States
FY 1973	$ 5 Billion			$ 0.872 Billion
FY 1974	$ 6 Billion			$ 1.308 Billion
FY 1975	$ 7 Billion			$ 1.528 Billion
TOTAL	$18 Billion	$ 9 Billion	$ 9 Billion	$ 3.708 Billion

47 projects are scheduled to be completed by 1978 which will result in adequate wastewater treatment facilities then being provided for 95 percent of the U.S. Great Lakes Basin sewered population.

Under the Agreement, Canada and the U.S. committed themselves to seek funds and legislation necessary to implement the remedial programs out- lined in Article V. During the past year public concern was expressed in both countries that the U.S. was not meeting its obligations with respect to providing municipal waste treatment facilities.

The States have expressed concern that the complexity of the engineering, financial and legal requirements of the Federal Water Pollution Act Amendments of 1972 (PL 92-500) are in fact retarding the implementation of their programs to construct needed municipal treatment works. The U.S. Environmental Protection Agency has acknowledged the slowdown in the awarding of construction grants but explained that while the program delay is unfortunate, the new legislation and regulations will strengthen U.S. programs designed to achieve and maintain national water quality objectives.

PL 92-500 authorized appropriation of funds each year as shown in Table 1. The amounts actually released by the Executive Branch of the U.S. Government are also shown. Approximately 40 percent of the available funds have been allocated to the eight states in which a portion of the Great Lakes Basin is located.

Litigation has been initiated by Minnesota, Pennsylvania, Wisconsin, Ohio and Illinois to obtain release of the nine billion dollars of the authorized funds that were impounded by the Executive Branch.

As of July 1, 1974, the Environmental Protection Agency estimated that $1.125 million of the $3.708 billion Great Lakes Basin States' allocation was available for projects in the Basin. Even with the projected funding levels, there are several major facilities which will not be completed by December 1975, although they may be, in the language of the Agreement, in the "process of implementation". The major cities are listed in Table 2.

Nonetheless, the Commission is concerned that the continued impoundment of appropriated funds will further delay completion of the 9 major municipal treatment plants listed in Table 2. When completed these facilities will provide needed treatment for one-third of the total sewered population on the United States side.

While the construction of needed municipal wastewater treatment facilities is essential, the Commission is also aware of the need for their efficient operation. The Commission intends in the future to request, from the responsible pollution control agencies, information with which it can assess the operating performance of all treatment facilities and can determine the availability of adequate funds and trained personnel to ensure their continued operation at optimum efficiency.

TABLE 2. MAJOR MUNICIPAL TREATMENT FACILITIES

which will not be completed until after December 31, 1975.

Treatment Facility	Sewered Population	Expected Completion
Detroit, Michigan*	3,129,000	1976
Duluth, Minnesota (Western Lake Superior Sanitary District)	126,000	1976
Gary, Indiana	175,400	1976
Cleveland, Ohio* (Westerly)	250,000	1976
Niagara Falls, N.Y.	102,400	1976
Hammond, Indiana	116,000	1977
Tonawanda, N.Y. (Sanitary District No. 2)	107,700	1977
Syracuse Metro, N.Y.	287,600	1978
Buffalo, N.Y.	750,000	1978

* Interim Phosphorus removal facilities are now in operation.

Cleveland, Ohio municipal waste discharge.
(Courtesy U.S. EPA-Documerica)

The treatment and disposal of municipal sewage sludge will require more attention, especially in view of the increased quantities of sludge being generated as a result of utilizing chemical precipitation for the removal of phosphorus from municipal sewage. The resulting increase in the concentration of toxic heavy metals in the sludge is creating potential problems with respect to its disposal on land.

Industrial Waste Treatment

The Commission has not assessed the status of industrial waste treatment programs because a major effort is underway in the United States, through the National Pollutant Discharge Elimination System (NPDES) permit program, to measure and control industrial pollution. Until this program is more fully implemented, a full evaluation of industrial pollution control is probably premature.

It is anticipated that greater and more effective monitoring and control of industrial waste discharges will be provided through the NPDES permit program. The permits, far from being licenses to pollute, are instruments of control. Conditions attached to the permits, surveillance of the operations under the permits, and provisions for changing, reviewing and revoking the permits ensure such control. Further, the initial permits are issued for a three year period. Issuance of the needed permits has been slow because of the time required for the development of effluent guidelines and permit processing procedures.

Legislation (PL 92-500) which established the NPDES program also provides that permanent authority to operate the permit program may be granted by EPA to a state which can satisfy the Administrator of the Agency that it is capable of doing so. Under this provision, the authority to operate the program was granted to the State of Michigan in October of 1973, and to Wisconsin and Ohio early in 1974. The remaining five Great Lakes States are expected to receive this authority by the late summer of 1974.

In the Great Lakes Basin over 2,000 applications for permits had been received and nearly 700 permits issued as of July 15, 1974.

The development of federal industrial effluent guidelines is proceeding in both countries. In the United States, 23 industrial category guidelines are already being incorporated in the NPDES. In Canada, three sets of federal guidelines covering the pulp and paper industry, mercury discharges from the chloralkali industry, and the petroleum refining industry have been promulgated. An additional twenty-seven industries will have Canadian federal guidelines and/or provincial

Steel mills at Gory, Indiana on the. Calumet River near Lake Michigan. (Courtesy U.S. CPA Documerica}

regulations governing the limits of effluent discharges permitted by 1978.

The Ontario program for the abatement and control of industrial waste discharges is essentially unchanged since the Agreement was signed in 1972. During 1973 approvals were granted for construction of industrial waste treatment works assessed at over $50 million. This compares with an average annual expenditure of about $15 million previously.

It is estimated that future expenditures of about $230 million will be required for industrial waste treatment works in Ontario, with about $140 million of this required by industries in the lower lakes basin to clean up existing problems.

In both countries technical problems are delaying control of thermal pollution, polychlorinated biphenyls, toxic and fish tainting substances in paper mill effluents, and high concentrations of dissolved inorganic solids from basic chemical plants.

Land Drainage

The contribution to pollution loads from agricultural and urban runoff, the unsewered population, and flows from storm sewers and overflows from combined sewers and other land use activities cannot be adequately quantified at present. The Commission's basin-wide studies now underway will provide baseline data with which to evaluate the situation and suggest remedial programs in these areas in the future.

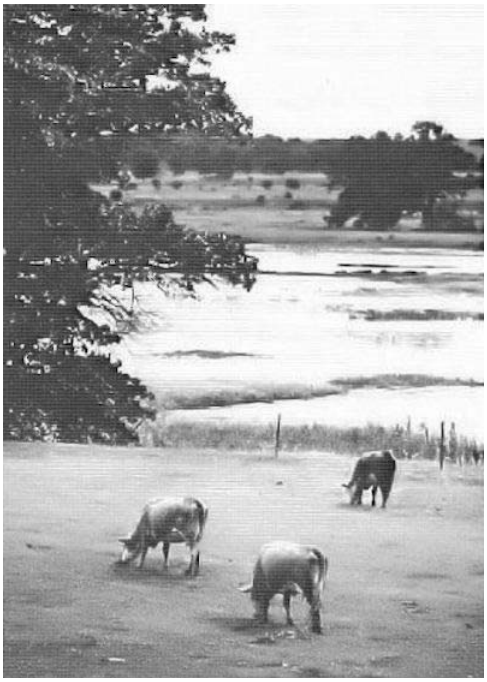
Pollution from storm and combined storm and sanitary sewer overflows continues to be a major problem in the Great Lakes, first, because separating them is expensive, and second, because demonstrated technology to control storm water runoff does not exist.

Several control and treatment techniques have been developed for combined sewer outflows. However, the very high cost of techniques has been a deterrent to their implementation. One possible approach, the complete separation of storm and sanitary systems, has been estimated to cost $1,315 million for Detroit and $285 million for Toronto.

Eutrophication

Although both land drainage and domestic sewage contain phosphorus which contributes to eutrophication of the Great Lakes, controls have been developed in the United States and Canada only for the municipal contribution. All jurisdictions in the Great Lakes Basin have now implemented programs for reducing the input of phosphorus to lakes and streams via municipal sewage.

In the United States, Minnesota, Illinois, Ohio, Pennsylvania and New York require that any municipal discharges greater than one million gallons per day (1.0 MGD) contain less than 1.0 mg/L of phosphorus. Michigan and Indiana require an 80 percent reduction, and Wisconsin an 85 percent reduction in the phosphorus of



Dairy cows grazing in a field north of Madison, Wisconsin. (Courtesy U.S. EPA-Documerica)

sewage at such plants. In addition, legislation has been passed restricting the phosphorus content of detergents sold in Michigan and New York to 20 percent, and in Indiana to 1 percent by weight. In Canada the Province of Ontario requires municipal discharges in excess of 1.0 MGD contain less than 1.0 mg/L of phosphorus. Nationally, Canada has also by regulation limited to 5 percent the phosphorus content of detergent. All of these requirements are designed to achieve the reductions in phosphorus loadings stipulated by the Agreement.

The municipal phosphorus removal programs are now being implemented on various schedules, with those in the Lake Erie Basin being given the highest priority. The Water Quality Board reported at 116 of the 198 municipal plants requiring phosphorus removal in the Lake Erie Basin were "on line" at the end of 1973. This provides phosphorus reduction for over 80 percent of the sewered population. By the end of 1975, it is anticipated that this will increase to over 90 percent.

The implementation of these programs has resulted in reductions of phosphorus loadings which, on the assumption that the required degree of treatment is being achieved, have been calculated to be greater than the target reductions projected in the Agreement. Before an accurate assessment of the impact of these remedial programs on phosphorus loadings can be made, it will be

necessary to analyze the actual performance of these treatment plants as well as the quality of their effluents.

Hazardous Materials

The Commission is concerned that toxic, infectious and other hazardous materials might be discharged to the Great Lakes from sources other than those previously discussed. More detailed information on the potential hazards is being developed for transmittal to governments.

Quarantine and International Health Measures

The Commission in its review of sewage disposal from ships in the Great Lakes is advised that although there have been no known recent incidents of communicable diseases being introduced into the Great Lakes by means of wastes discharged from vessels arriving from foreign ports, there is a potential for such incidents.

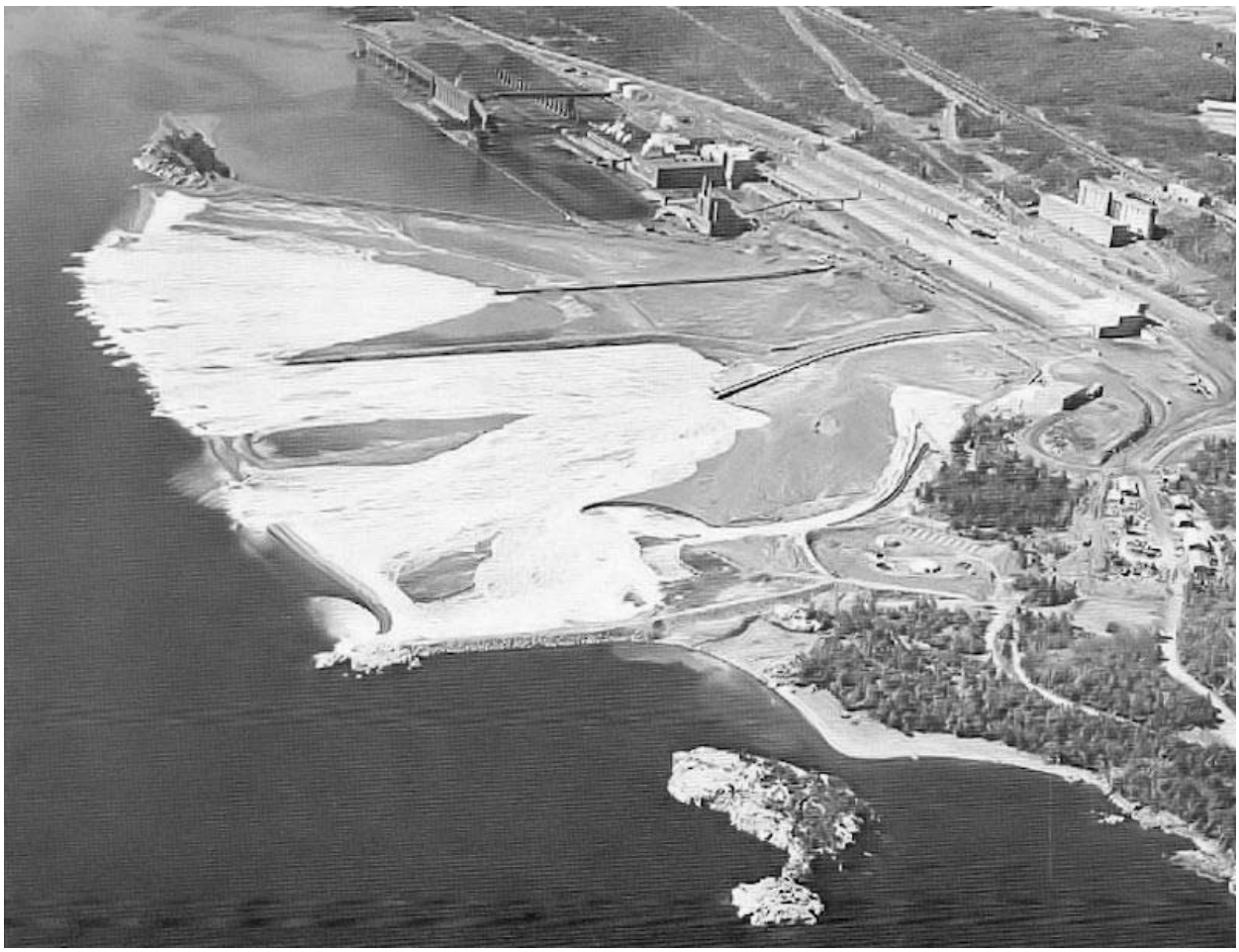
This subject is under continuing study by the Great Lakes Water Quality Board with a view to further identifying the hazard and, if appropriate, recommending remedial measures.

Asbestos

The massive discharge of taconite tailings by the Reserve Mining Corporation into the U.S. waters of Lake Superior, and their potential adverse effects on the ecology of the lake have been a major concern of environmentalists and residents of the basin for many years. Recent legal actions taken by the State of Minnesota and others have resulted in a decision that the discharges must eventually be eliminated. However, because adverse public health effects have not been proven, the discharge will be allowed to continue perhaps for as long as five years.

While the Commission has not been specifically requested by the Governments to study the Reserve Mining discharge problem, the matter does fall within the scope of the water quality studies being conducted on

Taconite tailings discharge of Reserve Mining Company at Silver Bay, Minnesota.
(Courtesy Basgen Photography, Duluth, Minnesota)



Lake Superior on behalf of the Commission by the International Reference Group on Upper Lakes Pollution. In the meantime, the Great Lakes Research Advisory Board is preparing a report on asbestos in the Great Lakes for the Commission which will be forwarded to the Governments with Commission comments as soon as it becomes available.

The Commission also wishes to express its concern that the implications of the recent judicial philosophy expressed by the Eighth Circuit Court of Appeals in the Reserve Mining case that "unknowns...may not be substituted for proof of a demonstrable hazard to public health" may have a significantly adverse effect on pollution prevention programs along the common frontier.

Viruses

The presence of viruses in man's environment is obviously a hazard to him. The extent of the hazard as it exists in the Great Lakes is unknown, and will remain so until serious research has been undertaken to establish the quantitative relationships of specific waterborne viruses to infectivity in man, with particular attention to people living or working in or near sewage treatment plants and to swimmers and bathers using beaches affected by treatment plant discharges. Research is also needed to improve the effectiveness of sewage treatment processes and plant operations in removing viruses from sewage, and to develop standard methods for sampling and laboratory procedures and adequate measures for baseline and monitoring studies.

The Commission has recently forwarded to Governments a report with recommendations on Virology Research Needs prepared by its Research Advisory Board.

Vessel Wastes

In the Agreement, the Governments committed themselves to adoption by 15 April 1973, of compatible regulations governing the disposal of vessel wastes in the Great Lakes. In its first annual report over a year later the Commission pointed out that compatible regulations had not been developed. At the same time the Commission endorsed the recommendation of the Water Quality Board that any compatible regulations developed accommodate a "no discharge" policy.

The Commission is concerned that another year has elapsed and the two Governments have not yet indicated agreement on compatible regulations. The major difficulties appear to focus on the issue of complete containment as opposed to the use of flow-through treatment systems, and the time which would be allowed for vessels to install the facility or system finally agreed upon.

In the meantime, recreational and commercial vessels face varying kinds and intensities of regulation in the various jurisdictions in the Basin. Complaints are continuing to be heard of unsightly wastes in the open lake waters and unsanitary conditions in many marina and port areas.

It is imperative that compatible regulations in accordance with the provisions of the Water Quality Agreement be promulgated without further delay.

Fish Contamination

The continuing high levels of persistent contaminants in fish, such as mercury, chlorinated hydrocarbons and their residues, DDT and PCB's, remain a concern to the Commission and environmental agencies in both countries.

In spite of noted reductions in levels of mercury in fish taken in some of the lakes, the Water Quality Board has also noted that concentrations in other areas are unchanged from 1971.

DDT concentrations appear to be declining in fish taken from most of the lakes, but PCB concentrations persist at high levels in the sediments, plankton and invertebrates on the lake bottoms. This is particularly significant as these levels may be sufficiently high as to adversely affect fish reproduction.

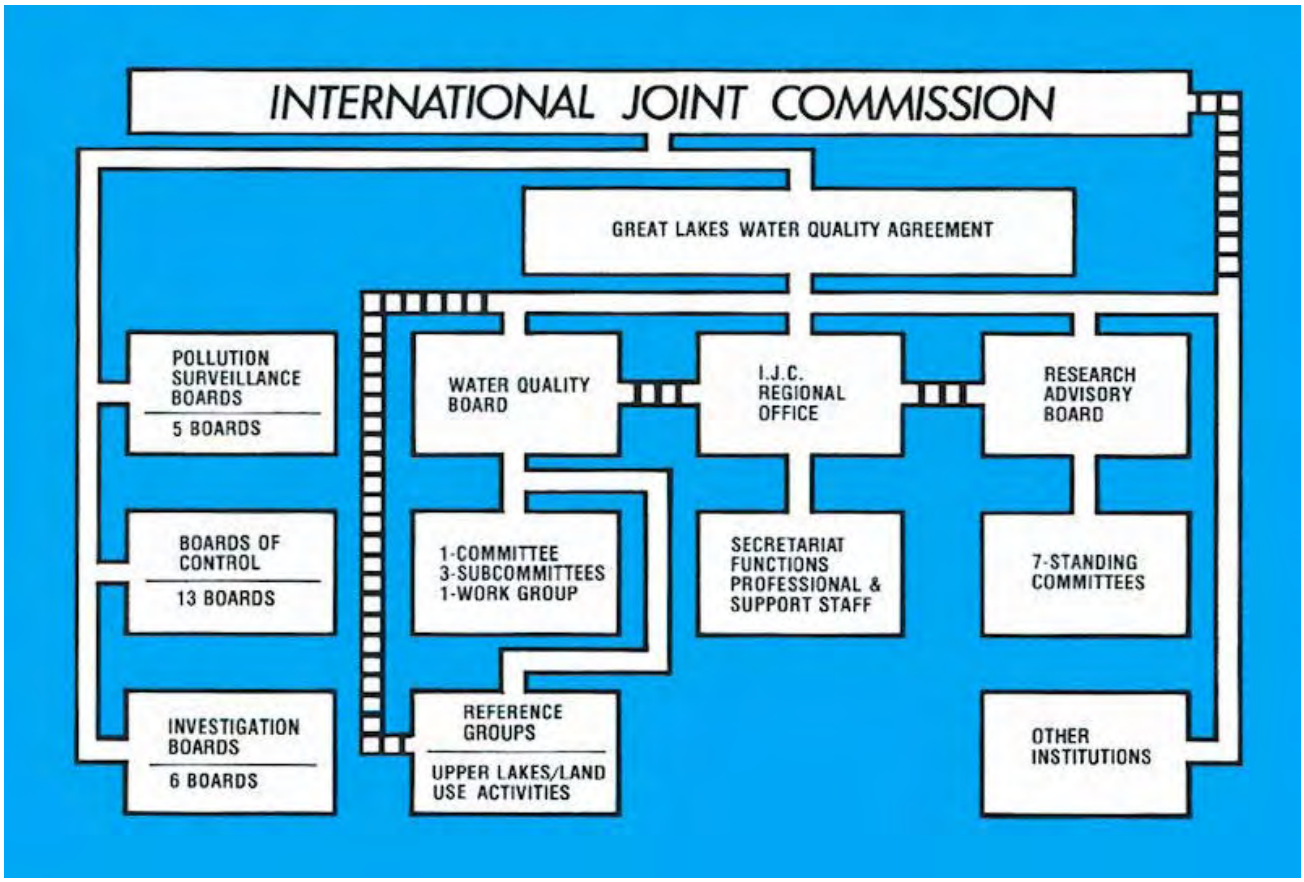
The Water Quality Board has advised the Commission that additional research is necessary to determine the environmental significance of the observed levels of PCB's in the biota and to evaluate their implications to human health.

CHAPTER IV
JOINT INSTITUTIONS

Major activities undertaken by the joint institutions created under the Agreement include those of investigation, study, coordination, communications and management. These are conducted or supported by the various boards, reference groups, and the regional office of the Commission. Their interrelationships are shown by the organization chart on Figure 2. Other international activities and institutions also relate to the Agreement.

FIGURE 2.

International Joint Commission Institutions
Secretariat/Liaison Functions.



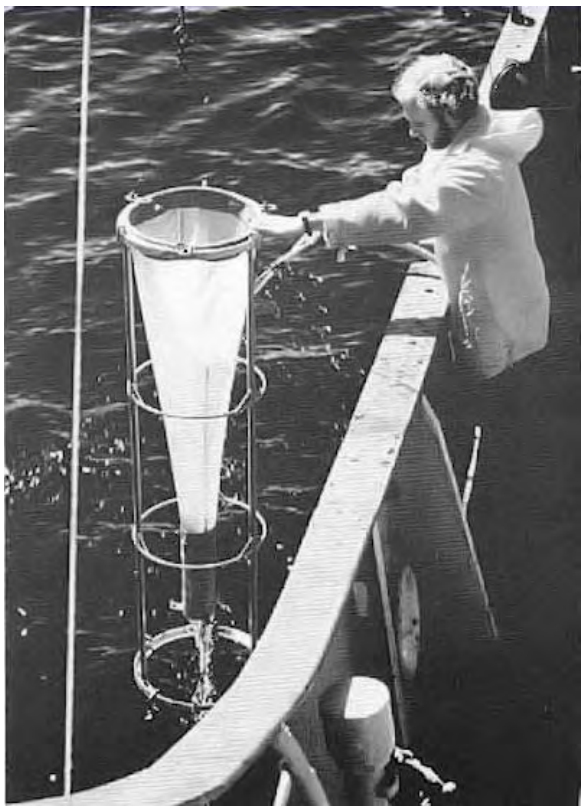
Great Lakes Water Quality Board

The Great Lakes Water Quality Board, composed of representatives of all major jurisdictions on the lakes, is the principal advisor to the Commission with regard to the exercise of all the functions, powers and responsibilities, (other than assistance in the coordination of research) assigned to the Commission under the Agreement. The activities described in Chapter III above, are being directed or coordinated by the Board. Since its organization in August 1972, the Board has held 12 meetings to review various aspects of the Great Lakes Water Quality Agreement and to advise the Commission concerning its implementation, progress and problems. The Upper Lakes and Land Use Activities studies discussed below are being conducted under the general supervision and direction of the Water Quality Board. The 1973 Annual Report of the Board to the Commission, released to the public in June 1974, reflects the increasing effectiveness of the Board in its assigned responsibilities.

Reference Group on Upper Lakes Pollution

A Detailed Study Plan on Upper Lakes Pollution was approved by the Commission in April 1974.

During fiscal year 1973/74, numerous lakewide surveys were conducted on Lake Superior to obtain physical, chemical, biological, bacteriological and geological samples. Some analysis has been completed. Winter sampling has been completed on Lake Superior and Lake Huron. An extensive study has been completed of the physical exchange of water between Lake Michigan and Lake Huron. The program for this year (1974/75) includes the completion of the collection of water quality data on Georgian Bay and Lake Huron as well as the initiation and completion of the major main lake fisheries program.



Plankton sampling in Lake Superior during a cruise of the Martin Karlsen, a Canada Centre for Inland Waters research vessel. (Courtesy U.S. EPA-Documerica)

Industrial, municipal, atmospheric and tributary loading; data are being collected to determine the sources and characteristics of material inputs. Progress is being made on the specifics of the loading and behaviour of materials from the Reserve Mining operations in Western Lake Superior. An initial assessment of the program is underway to determine its adequacy.

A number of special nearshore studies of local problems were completed on the Ontario side of Lake Superior. The Saginaw Bay study will be continued as

Electron microscope analysis for asbestos fibers at Duluth EPA Laboratory.
(Courtesy U.S. EPA-Documerica)

well as those studies on nearshore fisheries in Saginaw Bay, Lake Huron and Lake Superior in accordance with the study plan on coastal and local effects.

A study is in progress on whole lake effects for the assessment of pollution, the transport of pollutants and the establishment of base line levels against which to measure future changes in lake water quality.

The cost of the Upper Lakes study from the years 1973/74 to 1975/76 during which the report is to be completed is estimated at eleven and one-half (11.5) million dollars.

Reference Group on Pollution from Land Use Activities

In the future a continuing increase in population will result in new urban areas, more intensive agriculture and greater needs for energy and other resources. Unless preventive and control measures are taken, these future developments will result in increasing pollution loads upon the Great Lakes. It is essential to have adequate baseline data to quantify the water pollution loads from the various land use activities.

In April 1974 the Commission approved a detailed study plan developed by its Reference Group on Pollution from Land Use Activities to meet these needs. The plan established four major tasks to be undertaken as follows:

A - “To assess problems, management programs and research and to attempt to set priorities in relation to the best information now available on the effects of land use activities on water quality in boundary waters of the Great Lakes."

B - "Inventory of land use and land use practices and relevant physical data, with emphasis on certain trends and projections to 1980 and, if possible, to 2020."

In the United States, a general land use inventory will be completed by fall 1974 through the use of computer processing of ERTS-l satellite data.

C - ''Intensive studies of a small number of representative watersheds, selected and conducted to permit some extrapolation of data to the entire Great Lakes Basin and to relate contamination of water quality which may be found at river mouths on the Great Lakes, to specific land uses and practices."

Major watersheds selected for study are:

Canada - Grand River draining to Lake Erie; Saugeen River draining to Lake Huron; Wilton Creek draining to Lake Ontario.

United States - Genessee River, New York and Pennsylvania, draining to Lake Ontario; Black Creek, portion of Maumee River, Indiana, draining to Lake Erie, supplemented by a study in the Ohio portion of the Basin; Menominee River, Wisconsin, draining to Lake Michigan.

D - "Diagnosis of degree of impairment of water quality in the Great Lakes, including assessment of concentration of contaminants of concern in sediments, fish and other resources."

Detailed study plans have been prepared to evaluate shoreline erosion, survey river sediments and associated water quality, and effects of land drainage inputs on water quality of the Great Lakes System.

The Group proposed that its final report will be completed in 1977 at an estimated cost of $10,990,000. In addition, available estimates of the cost of ongoing Government programs relevant to the task of the Reference Group through the study period (1973-1977) total $8,209,000. The funding is being accomplished through the normal procedures of the Provincial, State and Federal governments.

Nuclear power plant under construction at the Bruce Peninsula along Lake Huron.
(Courtesy Ontario Hydro)

Early Action - As a part of its investigations of pollution of the Great Lakes from land use activities, the Commission was "requested to consider the adequacy of existing programs and control measures for a number of on-going land use activities and to identify deficiencies in technology and recommend actions for their correction." The programs and control measures to consider are related to inputs of nutrients, pest control products, sediments and other pollutants, land use planning, landfills, land dumping and deep well disposal practices, confined livestock feeding operations, and pollution from agricultural and forestry activities and others.

The Commission has recently forwarded to Governments recommendations for a series of early action programs to minimize pollution of the Great Lakes from land use activities which could be implemented by the appropriate levels of government without waiting for the completion of the Land Use studies. Major recommendations included the provision by Provincial and State governments of necessary funding to control and dispose of solid and liquid wastes on land, the strengthening of Federal, State and Provincial agricultural programs to provide extension and technical assistance to intensified animal husbandry operations, the establishment of systematized pest control and product inventory programs, reduction in the use of salt as a road de-icing agent, and the enactment of effective sediment control legislation with emphasis on urban and suburban areas.

View of the Ambassador Bridge connecting Detroit, Michigan, with Windsor, Ontario.
(Courtesy City of Detroit Public Information Department)

Other International Activities

In June 1974 the United States and Canada approved and signed a Joint Marine Contingency Plan for preventing and handling spills of oil and other noxious substances into the Great Lakes. It replaces an interim plan signed in 1971 and establishes clear lines of authority and action so as to overcome any possible response delays in emergency situations because of jurisdictional disputes.

Studies in both countries pursuant to Annex 5 of the Agreement are underway to recommend actions to strengthen programs and measures for the control of pollution from shipping activities. Study areas include reviews of present minimum standards respecting use of navigational equipment, the present informal system of traffic routes, existing traffic control systems, current U.S. and Canadian competency standards for manning vessels, the adequacy and effectiveness of existing aids to navigation, current research and development of systems for treating vessels wastes, and others.

The Governments under the Agreement were required to enter consultation by April 15, 1973, to develop an annex identifying hazardous polluting substances and defining the amounts considered harmful. In Canada a contract has been awarded to develop a list of Hazardous Polluting Substances in the Great Lakes Basin, and legislation to control the manufacture, sale and distribution of products hazardous to human health and the environment is under development.

The U.S. Federal Government has published effluent limitations on toxic heavy metals and toxic persistent organic chemicals. These actions will be helpful in developing an appropriate annex to the Agreement.

Control of Pollution from Dredging Activities

The Dredging Work Group has completed Phase I of the two-phase report which includes a general review of beneficial and deleterious effects of dredging on the environment, a history and description of dredging methods and practices, a review and assessment of dredging practices and disposal sites, socio-economic considerations at the municipal, state, provincial and federal levels and a review of legislation, regulations and guidelines. The Phase I report has been forwarded to the U.S. and Canadian Governments.

The Group is currently developing the details of a compatible dredging program for the Great Lakes (Phase II), which it expects to recommend to the two governments by April of 1975.

In addition, research projects totalling $3.9 M (2.5 U.S. and 1.4 Canadian) are now underway to assist the two countries in developing regulations for characterizing and disposing of dredged materials.

Research Advisory Board

This Board is the principal advisor to the Commission on the coordination of Great Lakes water quality research and the dissemination of such research information to agencies and interested persons.

The Board has prepared a list of a number of new or additional research needs including

(1) the development of practical indices which protect water recreationists from enteric, respiratory tract and fungal infections,
(2) the impact of temperature change due to waste heat on the ecosystems and,
(3) the obtaining of realistic estimates of the impact of nutrients and chemical contaminants from precipitation and dustfall. The list has been distributed to the research community for comment.

Several committees have been established by the Board to undertake specific projects including:

(a) completing a review of existing and proposed water quality objectives which concluded that a number of the objectives listed in Annex I of the Agreement could be refined utilizing scientific knowledge now available.
(b) preparing an interim report on the I.J.C. hearings process with an evaluation of its effectiveness in securing public participation.
(c) obtaining an in depth assessment of viruses in the environment and their potential hazards, and developing a report for the Commission.
(d) compiling a comprehensive "research forecast" of Great Lakes research projects in both Canada and the United States using a common format.
(e) investigating storage and retrieval systems on research literature to identify knowledge gaps on Great Lakes research activities related to water quality.

Great Lakes Regional Office

The Commission's Regional Office at Windsor, Ontario, was established in May of 1973, to provide technical and administrative support to the boards and sub-groups created by the Commission. Present staff strength includes ten professional and five support personnel. The Commission has approved a total staff strength of 25 for the fiscal year 1974-75.

The Regional Office function is being developed to serve as a focal point for all the Commission's responsibilities under the terms of the Water Quality Agreement. It will collect, collate, assist in the analysis of, and distribute information and data on behalf of and in cooperation with the Great Lakes Water Quality Board, the Research Advisory Board, the Land Use Activities and Upper Lakes Reference Groups, and the Commission.

In its first annual report, the Commission called attention to difficulties in Canadian hiring procedures which had delayed staffing the Regional Office. The Canadian Government, the Commission is pleased to note, moved quickly and effectively to overcome the problems and Canadian staffing is on schedule. The Commission has, however, experienced difficulty in hiring U.S. personnel and obtaining needed financial resources to meet its joint commitments to support the Regional Office.

CHAPTER V
CONCLUSIONS
AND RECOMMENDATIONS

Water Quality Assessment

The COMMISSION CONCLUDES on the basis of incomplete analyses of available data by its Great Lakes Water Quality Board and from numerous reports from public sources throughout the Great Lakes Basin that the increasing rate of degradation of the most seriously polluted lakes, Lake Erie and Lake Ontario, may have been halted. However, it has not been possible to determine with any valid statistical certainty that these two lakes in 1973 are better, the same, or worse than they were in 1970.

The COMMISSION FURTHER CONCLUDES that until adequate and accurate scientific validation is available, assessment of expected improvements in water quality in the lakes related to compliance with water quality objectives contained in the Agreement will not be possible.

The COMMISSION RECOMMENDS that Federal, State and Provincial governments provide, as soon as possible, the necessary financial and personnel recources to evaluate adequately the large amounts of water quality data now being collected on the Great Lakes by their respective agencies, as well as to meet any future required expansion of data collection programs.

Municipal Wastewater Treatment

The COMMISSION CONCLUDES that waste treatment plant construction programs which ensure progress toward meeting the water quality objectives specified in the Agreement are underway in both countries. The COMMISSION CONCLUDES that in Canada the present programs will be completed by December 31, 1975. In the United States it is now apparent that although the construction of waste treatment plants in most of the major metropolitan areas in the Great Lakes Basin will not be completed by the end of 1975 (see Table 2, page 13), they will be under construction at that time and thus "in the process of implementation" as required by the Agreement.

The COMMISSION FURTHER CONCLUDES that the present impoundment by the United States Government of funds appropriated by Congress for FY1973-74-75 for the construction of waste treatment plants will not seriously delay the planned construction program in the near future. However, failure to release or otherwise provide substantial funding in support of the construction program at an early date might later result in serious delays.

The COMMISSION RECOMMENDS that all funds appropriated by the U.S. Congress which would have been allocated to the Great Lakes States, but now have been impounded, be released immediately, that the State and Provincial governments give highest priority to construction projects in the Great Lakes Basin, and that the U.S. Environmental Protection Agency accelerate to a maximum its procedures for processing and approving grant applications and awards.

Eutrophication

The COMMISSION CONCLUDES that programs implemented by both countries have resulted in substantial reduction in phosphorus loadings to the lower Great Lakes, and FURTHER CONCLUDES that limiting by regulation the amounts of phosphorus used in the manufacture of detergents contributes substantially to the achievement of the agreed water quality objectives in the Great Lakes.

The COMMISSION RECOMMENDS that the U.S. Government seek legislation similar to Canadian law which limits the amount of phosphorus in detergent formulations.

Hazardous Materials

The COMMISSION CONCLUDES that there is a potential epidemiological hazard to populations within the Great Lakes Basin from the discharge of vessel wastes from ships arriving from foreign ports.

The COMMISSION RECOMMENDS that the two Governments consult at an early date to review present quarantine regulations and procedures to ensure their adequacy for minimizing this hazard.

Viruses

The COMMISSION CONCLUDES that as a general condition viruses are present in the environment at levels infective to man and therefore constitute a hazard.

The COMMISSION RECOMMENDS that the two Governments place greater emphasis on research concerning the epidemiological hazards of waterborne viruses associated with man's activities; and FURTHER RECOMMENDS that increased, coordinated research efforts on the disinfection of sewage effluent, including chlorination and ozonation, be directed toward the determination of the potential harmful effects of such practices as compared with the benefits.

Fish Contamination

The COMMISSION CONCLUDES that insufficient information is available on the presence of persistent contaminants in the Great Lakes to permit an assessment of their environmental significance and to evaluate the human health implications.

The COMMISSION RECOMMENDS that the two Governments develop a coordinated research program which will seek to determine the effects of PCB's on fish reproduction in the Great Lakes as well as their effects on human health.

The COMMISSION FURTHER RECOMMENDS that coordinated programs for the exchange of monitoring data on persistent contaminants be developed as soon as possible.

Vessel Wastes

The COMMISSION CONCLUDES that more than sufficient time has elapsed for the development and adoption of compatible regulations to control the discharge of vessel wastes in the Great Lakes, within the guidelines provided in the Water Quality Agreement.

The COMMISSION RECOMMENDS that the two Governments proceed without delay to promulgate regulations which are compatible and which will be at least as stringent as the guidelines set forth in Annex 4, paragraph 2 of the Water Quality Agreement.

Pollution from Land Use Activities

The COMMISSION CONCLUDES, on the basis of an Early Action Program report by the International Reference Group on Pollution from Land Use Activities and the Great Lakes Water Quality Board, that the two Governments should implement a number of programs to minimize pollution of the Great Lakes from land use activities, without waiting for the results of the extensive studies now being conducted by the Commission to identify the problems and make recommendations on remedial measures.

The COMMISSION RECOMMENDS that the Governments give early consideration to the early action recommendations of the Reference Group on Pollution from Land Use Activities and the Great Lakes Water Quality Board and endorsed by the Commission. These recommendations, in general, are as follows:

- All jurisdictions in both countries should accelerate their present programs to control the disposal of solid and liquid wastes on land;
- The Governments, acting on a priority basis should foster, facilitate and support increased land use planning and management programs at all jurisdictional levels;
- Federal, State and Provincial agricultural programs should be strengthened to provide extension and technical assistance to intensified animal husbandry operations;
- Systematized pest control product use inventory programs should be established in the Great Lakes Basin by the appropriate jurisdictions;
- The use of salt as a road de-icing agent should be substantially reduced; and
- Effective sediment control legislation, with emphasis on urban and suburban areas, should be enacted by the appropriate jurisdictions.

The International Boundary over the Niagara River. (Courtesy U.S. EPA-Documerica)