1975-07-01

Great Lakes Water Quality Third Annual Report To the International Joint Commission 1974

Great Lakes Water Quality Board

D. Konasewich

W. Traversy

H. Zar

GREAT LAKES
WATER QUALITY BOARD

INTERNATIONAL JOINT COMMISSION

GREAT LAKES WATER QUALITY
1974 ANNUAL REPORT

GREAT LAKES WATER QUALITY

THIRD ANNUAL REPORT

TO THE

INTERNATIONAL JOINT COMMISSION

GREAT LAKES WATER QUALITY BOARD

JULY 1975

GREAT LAKES WATER QUALITY

THIRD ANNUAL REPORT

TO THE

INTERNATIONAL JOINT COMMISSION

GREAT LAKES WATER QUALITY BOARD

JULY 1975

INTERNATIONAL JOINT COMMISSION
GREAT LAKES WATER QUALITY BOARD

July 1975

International Joint Commission
Canada and United States

Gentlemen:

The International Great Lakes Water Quality Board, as a requirement of the Water Quality Agreement of 1972, is submitting the following Annual Report on Great Lakes Water Quality prepared by the Board.

Respectfully submitted,

J.P. Bruce
Chairman
Canadian Section

Francis T. Mayo
F.T. Mayo
Chairman
United States Section

TABLE OF CONTENTS

Contents cont'd

LIST OF TABLES

LIST OF FIGURES

SUMMARY AND CONCLUSIONS

WATER QUALITY ASSESSMENT

The water quality of the open waters of Lakes Superior, Michigan and Huron is generally very good. However, problem areas exist, generally related to point source discharges or tributary inflows, where quality is degraded.

Lake Erie shows some apparent improvement in chloride concentrations, which is believed to be due to greater dilution associated with a higher flow through the Lake, since total chloride loadings to the lake have remained virtually constant.

Lake Erie shows some improvement in phosphorus concentrations in the western basin which apparently result from decreased phosphorus loadings. However, the oxygen depletion in the hypolimnion of the central basin has not improved and remains a serious concern.

Bacterial quality at Lake Erie beaches in Ohio and Pennsylvania continues to improve.

On the St. Marys River the long-standing problem of phenols, cyanide, oil and wood fibers associated with industrial discharges from Ontario still persists and phenol levels were higher in 1974 than during the period 1968-1972.

Water quality in the Niagara River is still degraded by municipal and industrial waste discharges from New York. Phenol levels show little change since 1967, but there has been a marked reduction in the number of oil discharges since 1967.

Lake Ontario shows early signs of oxygen deficiency in the deeper waters of the open lake. Local problems exist near tributary mouths and population centers along the shoreline.

St. Lawrence River phosphorus levels remain essentially unchanged from previous years. The area has a high potential for oil spill damage from the shipping activities on the river.

Although mercury levels in Lake St. Clair fish continued to decrease, high levels continue to be found in some fish from local waters of Lakes Erie and Ontario.

DDT levels continued to decline in Lake Michigan fish. However levels of polychlorinated biphenyls (PCB) show no evidence of a downward trend and are well in excess of the U.S. Food and Drug Administration (FDA) tolerance level of 5 µg/g in the edible portions of fish.

Dieldrin residues in Lake Michigan fish have remained near the U.S. FDA standard of 0.3 µg/g in spite of the implementation of use controls.

Along the shorelines of the lakes and connecting channels near population centers and mouths of tributaries, there are areas of depressed water quality. Remedial programs are

underway throughout the basin especially at major direct discharge points on the international waters to correct the problems.

Water quality surveillance programs are currently being conducted at a level that does not provide adequate information. Surveillance plans approved by the Water Quality Board will require increased commitments of funds and personnel.

MUNICIPAL POLLUTION ABATEMENT

During 1974, progress continued to be made in the construction of needed municipal treatment works. In Ontario, six new treatment plants and projects upgrading or enlarging eleven others were completed. In addition twenty-two new projects were initiated.

In the United States twenty-five projects each serving communities in excess of 2,500 persons were completed. The majority of these projects provided an upgrading of existing plants to secondary treatment. The release of $9 billion of impounded funds, originally authorized by the United States Congress in 1972 for the construction of municipal treatment plants, will provide adequate treatment for an additional 13 percent of the 1971 estimated sewered population on the U.S. side of the Great Lakes Basin.

However, difficulties encountered in the United States in implementing the complex requirements of PL 92-500 have led to many project delays. This means that completion of eleven major projects serving 6.3 million people will now be deferred beyond 1975. In 1973 major projects (Detroit, Cleveland, Buffalo, Niagara Falls and Duluth) serving 5.3 million people

were reported as being delayed. Further project delays occurred in 1974 at Gary, Euclid, Tonawanda and Syracuse. However, it is still anticipated that 60 percent of the sewered population on the U.S. side will have adequate treatment by the end of 1975.

In Ontario, delays anticipated in 1973 involved three projects in the Upper Lakes basin serving 110,000 people with the major project involved being Thunder Bay. Five project completions at Marathon, Midland, Parry Sound, Trenton and Iroquois serving a total of 34,000 persons will be delayed into 1976. Upon completion of these projects, 98 percent of the 1975 sewered population in the Ontario portion of the basin will be served with adequate sewage treatment.

There is a need to continue support, including financial, for the updating and improvement of sewage treatment works to accommodate growth and correct outstanding problems with combined sewers.

EUTROPHICATION AND PHOSPHORUS CONTROL

Programs for the reduction of phosphorus inputs to control eutrophication of the Great Lakes are progressing both in Canada and the United States. Loadings from municipal sources have been substantially reduced through implementation of programs to remove phosphorus from sewage treatment plant effluents. Additionally, three states and Canada have legislation limiting the content of phosphorus in detergents. However, compilation and evaluation of reported phosphorus loading data once again indicates various deficiencies in the reported estimates of total phosphorus loadings to the

lakes. Data collected in 1974 indicate that base loadings specified in the Agreement may have been low. Tributary data reported for the 1974 water year also appear to be incomplete and biased on the low side because of inadequate sampling programs. Inadequate data bases for both direct dischargers and tributaries make accurate assessment of changes in total phosphorus loadings to the lakes difficult, and limit the usefulness of predictive models being developed to help determine the effect of phosphorus control programs on future levels of algal biomass.

INDUSTRIAL POLLUTION ABATEMENT

A significant number of water quality problems and problem areas have been associated with discharges from industrial sources, both in Canada and the United States. Continuing concern for the abatement of such pollution is evidenced by substantial efforts on the part of Federal, Provincial and State agencies to implement their respective industrial waste control programs. While these programs are different for various jurisdictions the objectives are generally compatible, that is achievement of best practicable pollution control technology and attainment of water quality consistent with the objectives of the Agreement.

Progress continued in the implementation of industrial pollution controls in Ontario. Correction of outstanding problems with the pulp and paper industry on Lake Superior are staged and expected to be completed by 1977.

In the United States, NPDES Permits have been issued for 292 of the 312 major industrial dischargers. These permits contain two important elements: effluent limitations

and a schedule for attaining compliance with those limitations. The emphasis of the program is now shifting from the issuance of permits to compliance monitoring and enforcement.

OTHER ACTIVITIES UNDER THE AGREEMENT

A significant number of programs and other measures are being implemented in both Canada and the United States to control water pollution resulting from various land use activities such as land development, transportation, mining, agriculture, recreation, forestry, the surface and subsurface disposal of wastes and shoreline landfilling.

Compatible regulations for the control of vessel wastes have not yet been adopted.

The Board is concerned that reports on studies to prevent or control pollution from shipping activities as outlined in Annex 3 and 5 of the Agreement have not been published.

The dumping of polluted dredge spoils in the open waters of Lake Erie and Lake Ontario is continuing.

Increased activity in the development of specific programs for the control of hazardous polluting substances can be expected following the development in 1975 of an Annex to the Agreement identifying such substances and the quantities which are considered harmful.

The revised International Joint Contingency Plan for the control and clean up of spills of oil or other hazardous materials became effective April 1, 1974. Efforts are continuing to develop adequate methods for containing and removing oil spills in fast moving waters.

EFFECTIVENESS OF THE AGREEMENT

The true measure of the effectiveness of the programs and other measures contained in the Agreement will be compliance with water quality objectives in areas now degraded, and protection and enhancement of water quality in areas where quality now exceeds the objectives. Due to the very long response times of the main-lake waters, recovery of water quality in the more local "problem areas" will provide a more timely measure of program effectiveness.

In the U.S. all funds authorized in P.L. 92-500 for municipal treatment plant construction have now been released. Past delays in obligating available funds have been recognized and EPA has placed high priority in accelerating the obligation of the remaining money.

The primary emphasis of the Water Quality Agreement is to clean up existing pollution problems in the Great Lakes. The Agreement also calls for prevention of further pollution owing to population growth, resource development and increasing use of water. The Board wishes to draw attention to the latter provision, and to emphasize the need for effective water quality related land use planning to meet the needs of future growth and development consistent with the achievment of the water quality objectives. In addition, it is essential that funding be made available for an adequate surveillance program to assess progress in achieving the agreed to water quality objectives for the Great Lakes.

WATER QUALITY OBJECTIVES

New revised specific water quality objectives are proposed for the following:

Tainting substances
pH
Persistent organic contaminants
Unspecified non-persistent substances and complex effluents
Settleable and suspended solids and light transmission
Oil and petrochemicals
Asbestos

Specific objectives for metals and for non-persistent toxic substances are expected to be proposed later this year.

Suggested modifications to Articles I, II and III of the Great Lakes Water Quality Agreement have been developed for consideration in the event that major amendments are required. The modifications include a broadening of the concept of non-degradation to encompass enhancement of water quality.

RECOMMENDATIONS

The Great Lakes Water Quality Board recommends:

- that the Commission adopt the proposed coordinated Great Lakes water quality, biota, and sediment monitoring and surveillance programs detailed in this report and its Appendix B; and the Federal, State and Provincial Governments provide sufficient funding in support of these programs.

- that the United States Federal Government modify its new NPDES compliance tracking data system to allow data retrieval on the basis of hydrological basins.

- that special efforts be made to refine estimates of material inputs, particularly phosphorus, to each of the Great Lakes from municipal and industrial point sources atmospheric deposition, tributaries and the connecting channels.

- that in keeping with the earlier recommendations of the Board and the Commission, the Governments and jurisdictions develop compatible data collection, storage, and retrieval systems which readily permit interfacing and data exchange.

- that, in view of the continued serious problems with dissolved oxygen depletion in Lake Erie, Governments actively support continued investigations and research into the problem as a basis for assessing the effectiveness of remedial programs and modifying them as required.

- that the Governments and jurisdictions develop a coordinated program for use control of persistent organic contaminants, particularly polychlorinated biphenyls (PCB's), now affecting fish use and propogation in the Great Lakes and that the program be instituted at the earliest possible date.

- that changes in water quality in the areas identified in this report as "problem areas" be used as the primary basis for assessing the effectiveness of remedial programs. Further, adequate monitoring of these areas should be carried out to establish trends for, and the extent to which, all water quality objectives are being met.

- that the Federal, State and Provincial Governments assign a high priority to ensuring that adequate funding is available to satisfy continuing pollution control needs in the Great Lakes System. In the United States, EPA and the states should make a concerted effort to simplify complex regulatory requirements, streamline the administrative procedures, and place increased emphasis on the actual obligation of funds under the municipal treatment plant construction grants program. In Canada, the Governments should emphasize continued support for updating and improvement of sewage works to accommodate community growth.

- that efforts continue to be made to identify the extent of, and develop programs for, the control of pollution from combined sewer overflows.

- that, where it is still being practiced, the disposal of polluted dredged materials in the open lake waters of the Great Lakes be stopped.

- that in keeping with the previous recommendations of the Board and the Commission, the Governments adopt compatible regulations for the control of vessel wastes. The majority of the Board continues to support regulations based on a complete prohibition of the discharge of sewage.

- that the Commission request the Governments to clearly identify what programs and other measures are being implemented with respect to improving the design, construction and operation of vessels to prevent the discharge of oil and other hazardous polluting substances.

- that the IJC request the Parties to expedite the completion of studies being undertaken by the U.S. Coast Guard and Canadian Ministry of Transport to prevent pollution from shipping sources as detailed in Annex 5 of the Agreement.

- that a mechanism be found to fund adequate participation by the various jurisdictions in the activities of the Board to ensure that the information required in the annual assessment of Great Lakes water quality and the progress of all Governments in complying with the Great Lakes Water Quality Agreement is available.

- that Annex 1 of the Great Lakes Water Quality Agreement be revised to include the proposed new and revised specific water quality objectives as described in this 1974 Annual Report.

- that, pending modification of the Great Lakes Water Quality Agreement, the jurisdictions be urged to interpret the Agreement in light of proposed changes with respect to non-degradation and enhancement of water quality.

- that the Commission bring to the attention of Governments the need to consider the achievement of the water quality objectives in developing water management and water related land use plans.

INTRODUCTION

It has been just over three years since the Governments of Canada and the United States signed the 1972 Great Lakes Water Quality Agreement and thereby agreed to develop and implement programs and other measures deemed necessary to restore and enhance water quality in the Great Lakes System.

The International Joint Commission was directed to assist the Governments in implementing the Agreement and thereby assigned certain powers, responsibilities, and functions. The Great Lakes Water Quality Board was established as principal advisor to the Commission with regard to the exercise of all these functions, powers and responsibilities with the exception of coordinating needed research. This report, developed by committees of the Board, assisted by the IJC Great Lakes Regional Office, provides the basic information required by the IJC to make its report to the Governments on progress during 1974 in achieving the objectives of the Agreement.

In this report, the Board provides as assessment of water quality in the boundary waters based on available data. In addition, a proposal is presented for an IJC coordinated Surveillance Program to ensure that adequate data will be available in future for such assessments. Appendix B, the report of the Surveillance Subcommittee contains detailed analyses of water quality data and a complete description of the proposed IJC Coordinated Surveillance Program for the Great Lakes.

The progress achieved as well as delays in the implementation of programs and other measures to control pollution from municipal and industrial sources, land use, shipping and dredging activities and onshore and offshore facilities, are clearly identified. The control of oil and hazardous polluting substances through their identification and the implementation of a contingency plan to coordinate responses to pollution incidents resulting from spills of these materials is also reviewed. The Remedial Programs Subcommittee report, Appendix C, describes the remedial programs and other measures being implemented and evaluates their effectiveness.

The Board has reviewed the existing water quality objectives in the Water Quality Agreement and has proposed new and refined specific objectives for the Great Lakes. Details on the proposed water quality objectives and the "rationale" for them are contained in Appendix A, the report of the Water Quality Objectives Subcommittee.

WATER QUALITY ASSESSMENT

Information on water quality of the Great Lakes is obtained from surveys, investigations and routine monitoring activities conducted by a large number of institutions for various reasons. Some of the information is directly related to IJC activities such as the Upper Lakes Reference Study and Connecting Channels Monitoring while other information is gathered for research or enforcement purposes.

A general assessment of the water quality of each of the Great Lakes and connecting channels is presented based on information obtained from all available sources and assembled to indicate the water quality in specific areas and related to specific parameters. An indication of the cause and remedial actions being taken with respect to any adverse conditions identified is included. The detailed water quality data and remedial program information are contained in Appendix B and Appendix C respectively.

Detailed assessments and indications of long term trends in the water quality of Lake Erie, Lake St. Clair and the Detroit and St. Clair Rivers as well as a discussion of persistent contaminants in fish follow the general assessments.

The water quality information summarized herein, and presented in detail in Appendix B, defines certain problems and trends in the Great Lakes Basin. However, it is re-

cognized by the Water Quality Board that surveillance programs are needed which specifically address the objectives of the Water Quality Agreement. A proposed surveillance program, designed to achieve these objectives, is presented in this report together with an estimation of its cost. Details of the program and plan for implementing it are contained in Appendix B.

GENERAL ASSESSMENT OF WATER QUALITY CONDITIONS

Lake Superior

The quality of the open waters of Lake Superior exceeds that prescribed in the water quality objectives stated in the Agreement. However, some degraded water quality conditions do exist in near shore areas as a result of point source discharges, tributary inflows and erosion. The major problem areas are Duluth-Superior Harbor, Silver Bay, Thunder Bay and along the southern shore of the lake.

The nearshore water in the Duluth-Superior area is high in coliforms, phosphorus, suspended solids and turbidity. The major sources of the pollution are the Duluth and Superior Sewage Treatment Plants, U.S. Steel, harbor traffic and the St. Louis and Nemadji Rivers. By mid 1977, the nine sewage treatment plants in the Duluth area will be replaced by the Western Lake Superior Sanitary District and the Superior sewage treatment plant will be completed. Both these plants will provide secondary treatment with phosphorus removal and should result in a significant improvement in water quality conditions.

However, bottom sludges in these polluted areas affect water quality and contribute to a problem of low dissolved oxygen. These deposits will continue to have an impact on water quality even after point sources are abated.

The red clay bluffs area along the southern shore of Lake Superior is characterized by increased suspended solids and turbidity from shoreline erosion and tributaries which flow through the red clay deposits. Control of the problem is being addressed through the development of land management schemes and ongoing erosion control programs involving precautionary cultivation and construction practices.

The major source of degradation in Silver Bay is taconite tailings from Reserve Mining Company. Reserve has been ordered by the Eighth Circuit Court of Appeals on March 14, 1975 to reach agreement with the State of Minnesota within a reasonable time on a site of disposal of the tailing on land. With the cooperation of other federal agencies, EPA formed a task force, to work with the State in monitoring the progress made in complying with the court order. EPA will take legal action if it determines that Reserve's clean-up efforts are unsatisfactory.

Water quality problems at Thunder Bay include low dissolved oxygen, taste and odour in fish and high levels of coliforms. Total coliform levels in excess of 1,000 per 100 ml and fecal coliform counts in excess of 200 per 100 ml existed behind the harbor breakwall and out to about one mile off shore of the Kaministikwia River as far south as Mission Bay.

The significant sources include the city of Thunder Bay and the papermills of the Great Lakes and Abitibi Paper Companies. Remedial programs for the city include construction of additional sewers and two new sewage treatment plants. Waste loadings from the mills are to be reduced through in-plant modifications such as process recycling and consolidation.

Lake Michigan

Lake Michigan open waters are of generally high quality displaying only minor occurrences of degraded water quality that fails to meet the objectives in the Agreement. Three problem areas which have been identified as having significant water quality problems are Green Bay, Milwaukee Harbor and the Indiana Harbor Ship Canal.

The Milwaukee Harbor area is characterized by high coliforms, BOD, low dissolved oxygen and high suspended solids from storm-water and combined sewer overflows. A study is underway for deep tunnel storage and treatment of combined sewage. There is also an ongoing demonstration project for treating overflows by chemical coagulation and activated carbon. Interceptor sewers have been constructed.

Lower Green Bay has been identified as a polluted area being influenced by the highly industrialized and populous Fox River Valley. Dissolved oxygen levels are low and have been decreasing over the past thirty years. During warm weather, critical dissolved oxygen conditions are common in the Fox River and extend into Green Bay, a distance of 3 to 5 kilometers (2 to 3 miles). During cold weather, particulary under ice cover, low oxygen conditions extend about 50 km (30 miles) into the Bay. Phosphorus concentrations are high in the Bay and in the vicinity of the Fox River mouth, large areas of sewage sludge are found in the bottom sediments.

All major municipalities in the Fox River Valley have adequate treatment or a remedial program under construction. The latest schedules completion date is July 1977 for the City of Fond Du Lac. Programs are underway in most of the major municipalities to separate sewer systems and control storm water overflows.

Nine of the 12 papermills located in the Fox River Valley are in compliance with NPDES permit schedules. The consolidated Paper Company failed to attain operational level and was referred to the Attorney General. The Fort Howard Paper Company permit is pending an adjudicatory hearing and the Appleton Paper Company's is being modified. When these three companies meet their compliance schedules, water quality in the Fox River and Green Bay is expected to improve.

The Indiana Harbor Ship Canal is the main source of pollution in the Calumet area of Lake Michigan. It carries effluents from three municipal treatment plants, East Chicago, Gary and Hammond, and the industrial discharges from Atlantic Richfield, E. I. DuPont. Inland Steel, Union Carbide, United States Steel and Youngstown Sheet and Tube. The most noticeable pollutants are ammonia-nitrogen, chloride, cyanide and phosphorus. The municipalities presently have adequate programs for phosphorus removal and a decreasing trend was noted for phosphorus. However, all of the industrial dischargers are contesting the requirements of their permits through the adjudicatory hearing process. No significant improvements in effluent quality from these dischargers are expected until the cases are resolved.

St. Marys River

Phenol concentrations near the Canadian shore have been observed to increase in 1973 and 1974 in response to lower flows prevailing in the river during these years. Unsatisfactory levels persisted downstream from the Algoma main trunk sewer to Little Lake George. Transboundary movement was evident in the Lake George Channel. The elevated phenol levels may affect the taste and odour of water supplies and taint fish flesh; however, no problems have been reported to date.

Cyanide levels below the Algoma Steel main trunk sewer and downstream as far as 2.1 km (1.3 mi.), at a laterial distance of 400 feet from the Canadian shore exceed 0.2 mg/l, the permissable level for drinking water supply.

The Algoma Steel Corporation Ltd. is under Ministerial Order by the Province of Ontario for compliance of its waste control program by 1976 to correct the above problems in the St. Marys River.

Counts of total coliform found nearby the sewage treatment plant in Sault Ste. Marie, Ontario exceeded the IJC objectives (1000 org/100 ml) along a longitudinal distance of 1.3 km (0.8 mi.) and at a transverse distance of 180 meters (600 feet) from the Canadian shore.

During 1973 and 1974 surveys, mats of oil and wood chip fibers were present downstream from the locks as far as Lake George in the east channel with a lateral distance ranging from 90 to 180 km (300 to 600 ft.) from the Canadian shore.

Except for the specified areas mentioned above, the water quality of the St. Marys River is considered to be of the same excellent quality as Lake Superior.

Lake Huron

The waters in the main body of Lake Huron and Georgian Bay are of good quality and meet the objectives. On the U.S. side, one problem area, Saginaw Bay exhibits high concentration of nutrients, coliforms and total dissolved solids originating from the Saginaw River System. The biological communities of the Bay are also indicative of poor water quality. The significant discharges to the river and bay are the municipalities of Bay City, Saginaw, Milwaukee, Midland, Flint and Montrose and Dow Chemical and Monitor Sugar Companys. All dischargers

have remedial program or are in compliance with a permit schedule. As those schedules are completed, water quality in the river and bay is expected to improve.

On the Canadian side, Penetang Bay and, to a lesser degree, Midland Bay are sensitive to the nutrient inputs and support luxurious Cladophora growths close to the municipal sources. Chlorophyll levels in the waters of Penetang Bay are comparable to those of western Lake Erie.

Wastewater and drainage from the uranium mining activities in the Serpent River Basin are being treated for control of radium. The waste treatment procedures required will be maintained as a long term project.

Problems have been reported with taste and odour in fish taken from the North Channel at the mouth of the Spanish River. The suspected source of this is treated Kraft Mill wastes from the Eddy Forest Products Ltd. The company is reviewing the application of an oxygen bleaching process to correct the problem.

Detroit River

Numerous discharges of both municipal and industrial wastes cause water quality problems with coliforms, phenols and TDS in the Detroit River. These sources also contribute a large fraction of the total phosphorus load to Lake Erie.

The Detroit Metro plant, by far the most significant municipal discharge to the Great Lakes System, is undergoing large scale upgrading as detailed in the municipal programs section of this report. The Wayne County (Trenton) Sewage Treatment Plant provides only primary treatment and improved facilities are being planned. The Wayne County (Wyandotte) Sewage Treatment Plant currently providing primary treatment with phosphorus remova, has an activated sludge plant under construction.

The continuing presence of coliforms on the Canadian side of the Detroit River are believed to be related to malfunctioning private soil absorption systems in the Windsor and Amherstburg areas. Extensions are being made to local sewage collection systems to correct those outstanding problems.

Significant industrial discharges including Great Lakes Steel Corporation, McLouth Steel, Monsanto Industrial Chemical Company, Pennwalt Corporation, Allied Chemical Corporation, BASF Wyandotte, Ford Motor Company, Chrysler Corporation are schedules for compliance with NPDES permit effluent requirements no later than July 1, 1977.

Lake Erie

A detailed discussion of the water quality of Lake Erie is presented in the next section of this report.

Water quality problem areas in the Lake Erie Basin have been identified in Appendix C. The following discussion relates the most significant problem areas to probable sources and ongoing remedial programs.

Cleveland Area. Water quality in the Cleveland Harbor was found to be of poor quality with respect to BOD, phosphorus, nitrogen, total dissolved solids, and coliforms. A number of sewage treatment plants including Cleveland's three facilities and those at Euclid are being upgraded or expanded. Storm and combined sewer overflows are major causes of poor bacterial quality and high BOD, phosphorus and nitrogen levels. Industrial discharges in the area, include Harshaw Chemical Company, Jones & Laughlin Steel Corporation, Republic Steel Corporation, U.S. Steel Corporation, Allied Chemical, B.F. Goodrich Company, E.I. DuPont, and Firestone Tire & Rubber. Some of these plants have implemented remedial measures as a result of previous state and federal requirements. Currently,

however, almost all of the listed industries are contesting further requirements through the adjudicatory hearing process. Until the cases are resolved, no significant improvements are expected in the effluent quality from these dischargers.

Toledo Area. The waters of Maumee Bay are of poor quality with respect to BOD, nutrients, coliforms, and TDS. Much of the nutrient load results from agricultural runoff in the Maumee River Basin. Demonstration projects intended to develop practical means of reducing such inputs through land management practices are underway.

The coliform and BOD nutrient problem also results from storm and combined sewer overflows. No significant projects are underway to remedy this problem. Some municipal dischargers in the Basin providing secondary treatment are undergoing expansion and upgrading to advanced waste treatment. This includes the Lima, Findlay, and the Van West sewage treatment plants. Industries which now have NPDES permits include Gulf Oil Corporation, Standard Oil of Ohio at Lima, Weatherhead, Campbell Soup Company and the Vistron Corporation. Standard Oil of Ohio at Oregon and Interlake are awaiting adjudicatory hearings.

Grand River Area. The major problems in this area are the high values of chloride and TDS resulting from the industrial waste discharge of Diamond Shamrock Chemical Company into the Grand River. No permit has been issued as the company is contesting requirements contained in the proposed NPDES permit. Improvement in the chloride levels in this area is not expected in the near future as the only obvious means of reducing chloride discharged to Lake Erie is the curtailment of operations.

Additional problems in the area may be due to the Painesville and Fairport Harbor Sewage Treatment Plants, both of which are providing primary treatment. It is anticipated that advanced

waste treatment with phosphorus removal will be required.

Fredonia, Westfield Area. Along the New York State portion of Lake Erie, there are two major problem areas. At Canadaway Creek near Fredonia, municipal and cannery wastes contribute to excessive nutrient loadings. Proposed expansion of an overloaded treatment plant and the addition of phosphorus removal should greatly reduce this problem.

In the Westfield area, Chautauqua Creek carries both municipal and cannery wastes to Lake Erie. These dischargers are to be tied into a proposed secondary treatment plant which will provide phosphorus removal.

Niagara River

Industries on the Buffalo River and along the main channel are the major sources of pollution of the Niagara River on the United States side. Few sources of pollution are found along the Canadian portion of the river.

Water quality of the main stream of the river is basically similar to Lake Erie water; however, noticeable changes in water quality do take place along the river bank on the upper river particularly on the United States side. Bacterial contamination may be found in an area starting at the confluence of the Buffalo River and extending downstream to approximately the tip of Grand Island. A major contributor is the Buffalo River which receives various types of municipal and industrial discharges plus overflows from the Buffalo Sewer Authority's combined sewers. Slightly downstream the river receives a chlorinated primary effluent discharge from the City of Buffalo. However construction is underway at Buffalo to upgrade this plant to secondary treatment with phosphorus removal. Downstream from Buffalo in the upper river, there are other areas of scattered bacterial contamination generally found near the outfalls of major municipalities.

Such areas exist near the Town and City of Tonawanda, Town of Grand Island and the City of North Tonawanda.

Although the river serves as a receiving body for a multitude of municipal and industrial discharges, no violations of the dissolved oxygen standards have been reported. Correspondingly, the BOD, total phosphorus and total coliform levels remain generally low for the entire reach of the river.

Phenol data collected since 1967 show little change to date. Recent information shows that the water near the U.S. shore in some areas on the upper river contains phenol which, at times, exceeds 5 µg/l.

Oils continue to cause more obvious damage than any other single pollutant; however, observations indicate a marked improvement since 1967. Significant oil and grease discharges have been curtailed by the majority of oil terminals, refineries and other industries. Accidental spillage continues, but an increased effort by government and industry may be expected to keep oil pollution problems under control.

Lake Ontario

The open waters of Lake Ontario are showing some of the signs of degradation that are evident in Lake Erie but while not as severe as the upstream lake, they are danger signals that will bear close observation in the future. Surveys in 1974 indicated a larger number of locations with low dissolved oxygen levels than in 1970. The dissolved oxygen content at many of these locations was below the 80 percent saturation level and in two locations was less than the IJC objective of 6 mg/l. The total dissolved solids measurements in the Lake exceeds the objective level of 200 mg/l. The open waters of the lake respond to the loads it receives from the upper lakes as well as its

tributary area making it impossible to specify a cause and effect relationship with individual sources.

There are a number of problem areas identified along the shoreline of Lake Ontario that result from local sources of pollution.

Just east of the Niagara River mouth, beaches have been closed periodically because of high coliform counts. Several sources contributing to this problem are discharging to the Niagara River. All are providing some treatment but require upgrading which is already underway.

The Genesee River enters Lake Ontario at the Rochester Embayment. This area suffers from waste discharges from numerous sources which have resulted in the closing of three area beaches. Plans which were implemented several years ago resulted in the consolidation of thirty-three (33) small treatment plants into 4 regional plants. Three of these plants have already been constructed and the fourth should be on line by the end of 1975.

In addition to these municipal discharges another major source is the combined sewer overflows to the Genesee River. Currently, there is a research and development project underway to provide the most economically feasible approach to resolving this problem. A pilot plant project is under construction in addition to an automated monitoring network to provide necessary data for resolution of the problem.

At Oswego, the harbor area has been subjected to several major municipal and industrial discharges which caused solids, high coliform, and nutrient problems. Major difficulties have already been resolved through provision of adequate treatment by Armstrong Cork and a new eastside Oswego secondary treatment plant with phosphate removal. The sole industrial direct dis-

charger in this area, Hammermill Paper Company, is now discharging to the eastside plant after pretreatment. The only remaining significant dischargers will be tied to a new westside municipal sewage treatment plant at Oswego which should be underway in the immediate future.

At the northeastern edge of Lake Ontario, the Black River discharges a substantial nutrient load into the bay. Nutrient loadings have already been reduced through abatement of major paper mill discharges. Further reduction is expected within the next few years, but the bay will continue to suffer from nutrient overloads due to heavy sawdust deposits from oil paper mill discharges and periodic runoff from floodprone farmland in the watershed.

The Bay of Quinte contains excessive levels of total and fecal coliforms near Trenton and Picton. Eutrophication in the Bay of Quinte is also a problem caused by nutrient input from municipal discharges. The shallow depth and slow flushing action and nutrient materials carried by local drainage are expected to contribute to a continued aquatic growth in the bay over the next few years even following completion of municipal phosphorus control programs in 1975.

The Toronto Harbour and waterfront areas are subject to high levels of total and fecal coliforms close to shore. Completion in 1975 of the mid city sewer interceptor program by the City of Toronto will correct discharges from combined sewers into Toronto Harbour which have contributed significantly to the problem.

In Hamilton Harbour dissolved oxygen, iron, heavy metals, coliforms, PCB's and phosphorus generally exceed water quality objectives. Waste treatment projects at the steel companies in Hamilton are scheduled for completion in 1975 to correct dis-

charges to the harbour of a variety of organic and heavy metal pollutants. Completion of the Hamilton sewage treatment plant is expected to improve the water quality conditions in the bay.

St. Lawrence River

On the U.S. side of the St. Lawrence River water quality problems have been reported in at least two areas affected by the municipal inputs from Massena and Ogdensburg. The sole industrial input identified was the high fluoride discharge to the Lower Grass River at Massena from Alcoa Aluminum.

In addition it was reported the most significant water quality problem facing the St. Lawrence River is the high potential for major spillage of oil and other hazardous materials due to shipping accidents, particularly with extended navigation on the Seaway as proposed. Critical waterfowl areas and high-use recreational areas are especially susceptible to damage from spillage since experience has shown the difficulty (or impossibility) of efficient containment and cleanup in the swift river currents and narrow channels of the Thousand Islands area.

Mean total phosphorus concentrations from three surveys conducted in 1974 were 0.018, 0.028 and 0.019 mg/l respectively for June, August and October. This seasonal pattern of higher total phosphorus concentrations in mid-summer was also observed in 1973 although not as noticeably as in 1974. The early summer total phosphorus levels in 1974 were not significantly different from the levels found in 1973. Phosphorus removal for municipal and industrial dischargers on the Ontario side of the river are expected to be in place in 1975 and 1976 respectively. Industrial inputs of nitrogen, BOD and suspended solids are also expected to be substantially reduced by 1976.

DETAILED ASSESSMENT OF WATER QUALITY IN LAKE ERIE (including the Detroit River, Lake St. Clair, and the St. Clair River)

Lake Erie has been the object of concern for both the general public and scientific investigators for the past decade resulting in information on water quality from a large number of agencies which was examined in depth and summarized to give an indication of the condition of the lake and the contributing connecting channels and to identify trends in water quality that would be evident from a review of several years of data.

The results of these assessments are summarized for each of the major parameter groups for which adequate information was available.

The information, details of which are presented in Appendix B, provides both an assessment of water quality and the basis for a preliminary design of the surveillance program presented herein.

Chloride, Total Dissolved Solids, Conductivity

Chlorides, TDS and conductivity are a group of measurements which are indicative of general conditions. Chloride is a very specific item, which, since it is quite conservative, can be traced through the system without concern for its loss or chemical interactions. Analysis of chloride data usually provides the traces of dilution effects free from other interferences and provides a base reference for parameters affected by interactions and loss within the system.

Conductivity and dissolved solids are closely related. An objective of 200 mg/l has been set as an IJC objective for total dissolved solids, but conductivity data are more readily obtained due to ease of measurement. Appropriate conversion factors can be applied to conductivity data to provide a TDS value.

Tracing these parameters from the outlets of Lake Huron through to the head of the Niagara River, it is found that the chloride loading to the system from Lake Huron has increased in proportion to increases in flow; that with decreases in local loading in some locations; and with increases elsewhere, the loading to the whole system from point sources and tributaries has remained virtually constant over the past 10 years. The result is a chloride concentration in Lake Erie which has decreased since 1968 due to increased flowthrough. As flows through the system return to normal or below normal, concentrations will again increase; first in the western basin, and subsequently the rest of the lake - if loadings remain the same.

Total dissolved solids levels do not violate the 200 mg/l objective in the St. Clair River - Detroit River System. However, levels in the west-central and eastern basins of Lake Erie come very close to that objective. Some uncertainty remains about the factor to be used for Lake Erie waters in converting conductivity data to TDS. Levels during the period from 1966 to 1971 come within the range of factors uncertainity. A drop of conductivity and TDS has been noted since the late 1960's to where basin averages are now all below 200 mg/l. This drop is comparable with the drop in chloride levels and is therefore probably due to increased flowthrough in the system - a dilution effect. Return to normal or below normal flows will result in increased TDS and conductivity if TDS loading is held constant.

Nutrients

The key nutrient subject to remedial measures is phosphorus. Tracing it through the system, it is found that phosphorus transport out of the St. Clair River system has not changed significantly in spite of increased flow. However, there are reported reductions in phosphorus loading to the system below the St. Clair River. This is reflected in part in reported reduced loading through the Detroit River to Lake Erie.

Since the Detroit River is the principal source of phosphorus for Lake Erie, changes should be evident first in the western basin. Since phosphorus interacts substantially with biota and bottom sediments it is not easily subject to a closed material balance calculation for the lake. Nonetheless trends should be reflected in nearshore areas close to major phosphorus inputs.

Some reduction in total phosphorus concentrations for surface water and the total phosphorus content have been reported for the western basin of Lake Erie. Central basin data show no reduction in phosphorus concentrations and no change in total phosphorus content. No change is evident in the eastern basin. Phosphorus levels reported show wide seasonal variations. This makes trends difficult to discern.

Total inorganic nitrogen in the open lake shows no significant change, while there have been increases in regions such as the mouth of the Grand River. Highest values occur in spring in the west basin.

Dissolved Oxygen

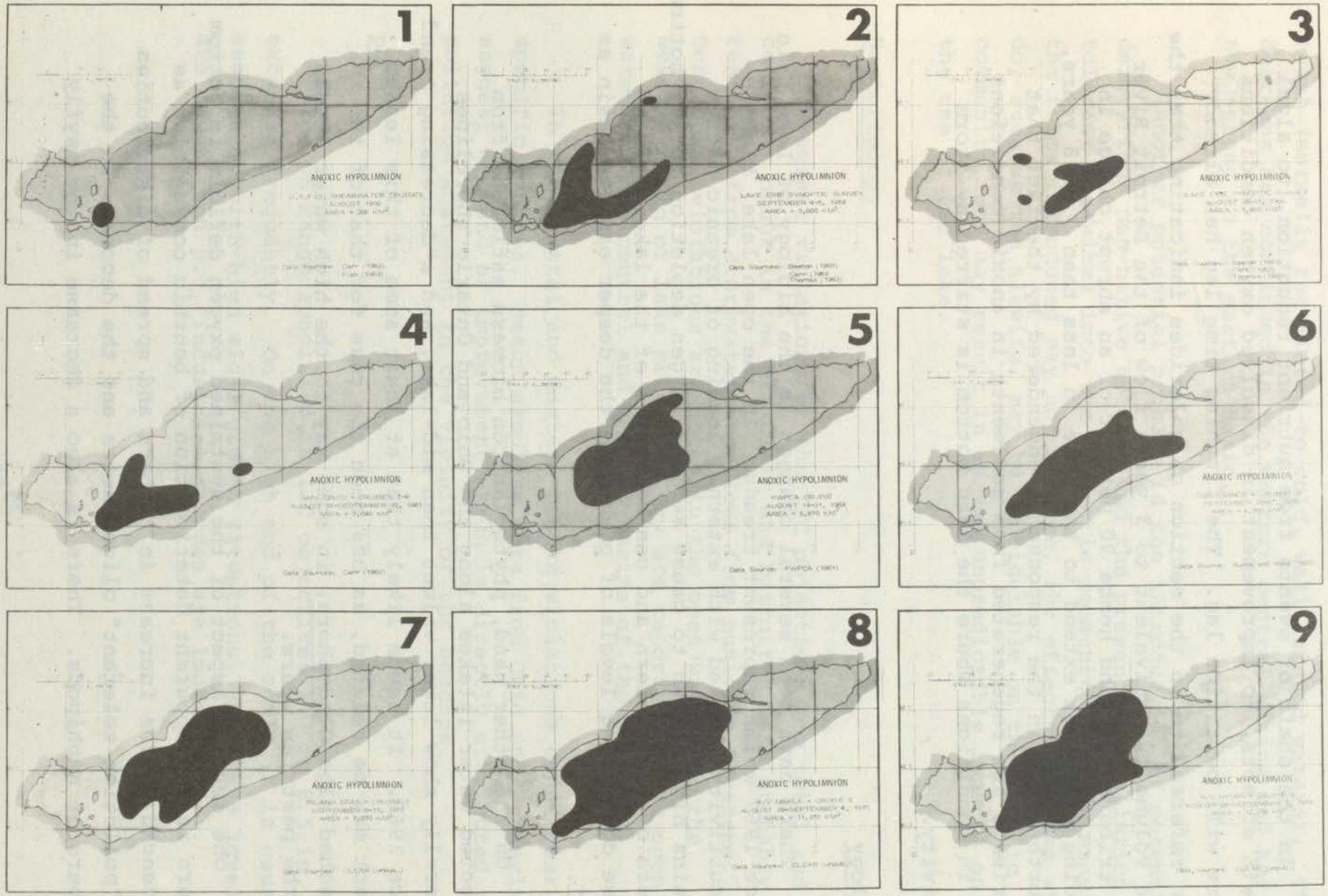
One of the major concerns in Lake Erie is the depletion of dissolved oxygen in the hypolimnion of the lake during the period

of summer stratification. The extent and rate of this oxygen depletion have been the subject of an extensive study, (see Appendix B) in an effort to develop historical trends.

The extent of oxygen depletion in the hypolimnion in the central basin, Table 1, in the past 2 years has reached close to the maximum possible, while oxygen depletion rates have held steady (within $\pm$ 15%) for the past 5 years. Better measurements are available for recent years, making detailed comparisons with earlier years more difficult, but a doubling of the area involved, between 1930 and the mid 1960's is clearly evident in Figure 1, and is being stabilized in the recent past at those higher levels.

TABLE 1
ESTIMATED AREA OF THE ANOXIC HYPOLIMNION
OF THE CENTRAL BASIN OF LAKE ERIE 1930 - 1974

Year	Area (km^2)	Percent of Central Basin	
		Hypolimnion	Total
1930	300	3.0	1.9
1959	3,600	33.0	22.3
1960	1,660	15.0	10.3
1961	3,640	33.0	22.5
1964	5,870	53.0	36.3
1967	7,500	68.0	46.4
1970	6,600	60.0	40.4
1972	7,970	72.5	49.3
1973	11,270	93.7	69.8
1974	10,250	87.0	63.4



EXTENT OF ANOXIC HYPOLIMNION IN LAKE ERIE (1930-1974)

FIGURE 1

In the chain of events from nutrient reduction, to algal growth effects, to improvement in dissolved oxygen conditions there will be a time lag. The flushing time lag has already been referred to in the section on chlorides indicating that the lake volume is equivalent to 3 years flow of the Detroit River and tributaries, and hence 90 percent of an abrupt change in loading would not extend to the lake in less than 7 or 8 years. A further lag in the response is engendered by the fact that nutrients are regenerated from sediments in anoxic conditions and in conditions where the lake bottom is stirred by storm activity.

Biology

There have been several changes in the biology of Lake Erie since 1967 which represent trends. In the open lake, biomass productivity coupled with external loading of organic matter remains high enough to cause serious oxygen depletion in the bottom waters of the western and central parts of the lake, and to cause decreasing levels of oxygen in the deeper eastern basin as well.

On the other hand, phytoplankton biomass estimates from selected water intakes along the Ohio and Ontario shorelines generally show lower values than mid-lake, and a decreasing trend since 1967. It seems likely that at least some of this lesser impact may be related, as has been the case for that of the attached alga Cladophora, in some way to the high water levels of the past few years.

One serious aspect of the sustained oxygen deficit in bottom waters is the apparent deterioration of benthic communities as evidenced by the increase in numbers and spread of distribution of "pollution tolerant" oligochaetes and the decrease in the numbers of amphipods. There is also a decrease in the mayfly

nymph (normally restricted to cold, well aerated waters). This decrease has continued in the western central basins and has now spread to the eastern basin.

Another potential problem is the introduction of potentially deleterious non-native species and the presence of pollution - tolerant organisms into the Lake Erie community. While many of the forms introduced may not survive, the effects of those which do, such as the alewife, may be considerable on the aquatic community, and may result in as yet unpredictable impacts on the use of the lake.

Bacteriology

Frequent violations of the IJC objectives for total and fecal coliforms occur in the St. Clair and Detroit Rivers probably resulting from stormwater overflows from municipal systems. Occasional violations are noted in the open waters of the western basin of Lake Erie, and few are reported in the open waters of the central and eastern basins of the Lake.

In the central and eastern basins violations occur near specific sources. Beach sampling data from Ohio and Pennsylvania suggest a trend of improvement which is directly attributed to pollution abatement in the vicinity of the beaches.

pH

The pH range specified in IJC objectives 6.7 to 8.5 is exceeded frequently. On the high end of the scale it is usually associated with high algal growth situations, and where levels are lower than 6.7, industrial sources are implicated.

Toxic Materials

At present the availability of information for toxic materials is rather limited. While no adverse reports on the quality of the water per se have been noted, measurements of sediments and biota indicate areas of possible concern.

Reports on harbour dredging activities and information from sediment sampling surveys in the western basin of Lake Erie indicate elevated levels of several heavy metals. These levels have not been associated with any deterioration of water quality.

Volatile organics and radioactivity levels do not appear to be any cause for concern at the moment. Pesticides generally are undetectable in the open waters of Lake Erie, however, studies regarding reproduction failures characterized by poor hatchability of herring gull eggs indicate contamination does exist.

PERSISTENT CONTAMINANTS IN FISH IN THE GREAT LAKES

For several years most environmental agencies in the states and provinces bordering the Great Lakes have monitored a variety of persistent contaminants in fish. Attention has focused on mercury and chlorinated hydrocarbons and their residues, including PCB's. More recently, many surveillance programs have included other metals in addition to mercury. Because of problems in interpretation of data, discussed later, it is difficult to identify trends in contaminant levels over time. Nevertheless, some general conclusions are possible.

Concentration of Metals in Fish

High mercury levels in fish led to the banning of commercial fishing in Lake St. Clair and for walleye in the western basin of Lake Erie in 1970. At that time the regulatory agencies took steps to eliminate industrial discharges of mercury. Monitoring programs were initiated to assess the concentrations of mercury in fish throughout the Great Lakes.

Perhaps the clearest trend in contaminant levels in any of the Great Lakes is the steady decline in mercury levels in fish of Lake St. Clair. Results of testing by the Ontario Ministry of the Environment indicate that in samples of similar sized fish, levels declined 36-64 percent from 1970 to 1974 (Table 2). The progressive reduction in levels from year to year is evident, although the decline has apparently slowed somewhat. Consideration is now being given to allowing the resumption of commercial fishing on a selective basis.

Mercury data for fish from Lake St. Clair permit an evaluation of the effectiveness of regulatory controls and the dynamics of mercury in large aquatic systems. Previous estimates of the time required for mercury to return to background levels have been as long as 100 years. The data indicate that regulatory controls have led to a rapid reduction in the level of mercury contamination in Lake St. Clair fish.

Trends in mercury contamination elsewhere in the Great Lakes are not so clear. High mercury levels (in excess of 0.5 µg/gm) continue to be found in some fish from localized areas such as the eastern end of Lake Ontario and the western basin of Lake Erie. In other areas mercury levels have

TABLE 2

MERCURY LEVELS IN LAKE ST. CLAIR FISHES

Species	Mean Mercury Levels (µg/gm)					Percentage Decline In Mercury Levels 1970-1974
	1970	1971	1972	1973	1974	
Walleye	2.3	1.8	1.4	1.1	1.2	48
Northern pike	4.4	4.9	4.4	2.7	2.5	43
Yellow perch	N.A.[1]	N.A.	N.A.	0.6	0.4	-
Rock bass	N.A.	4.1	2.2	1.1	1.1	-
Smallmouth bass	N.A.	3.3	2.3	1.4	1.5	-
White bass	2.2	2.4	1.9	1.2	0.8	64
Freshwater drum	N.A.	1.3	0.7	0.9	0.6	-
Channel catfish	1.4	1.7	1.3	1.0	0.9	36

[1] Not Available

apparently declined, as in Thunder Bay and southern Lake Huron, and a resumption of commercial fishing has been possible in some cases.

Information as to contamination by other metals is not as extensive as for mercury. The Great Lakes Fishery Laboratory in Ann Arbor, Michigan, carried out a survey of numerous metals in Great Lakes fish during 1971 and 1972. Elevated levels of arsenic were found in several species from Lakes Michigan and Huron, while slimy sculpins contained high levels of cadmium, chromium and copper. The latter metals did not appear to be concentrated in fish further up the food chain. Nevertheless, the results raise many questions concerning the source, food-chain relationships, and possible effects of these metals in slimy sculpins and other bottom feeders.

Elevated levels of heavy metals have been found in sediments at numerous locations on the Great Lakes, particularly in harbour areas. Accumulation of large quantities of metals have occurred in some cases, as in Hamilton Harbour where up to 930 µg/gm lead and 295 µg/gm chromium were found in sediment samples in 1972. Levels in fish are correspondingly high in some cases. A 1973 comparison of fish from Toronto Harbour and from an unpolluted area of Lake Huron indicated the harbour fish contained some eight times as much zinc and thirty times as much lead as did the Lake Huron fish.

Chlorinated Hydrocarbon Concentrations in Fish

Despite numerous efforts to monitor levels of pesticides and polychlorinated biphenyls (PCB's) in Great Lakes fish, most surveillance programs are of recent origin and relate to very localized areas. Assessment of levels on a lakewide basis is thus difficult.

Trends in contaminant levels are perhaps clearest for Lake Michigan. Annual monitoring of chlorinated hydrocarbons was initiated in 1969 by the Great Lakes Fishery Laboratory. Results to date (Table 3) indicate a steady decline in DDT concentrations following the imposition of restrictions on the use of DDT in Michigan in 1969-70. The trend is consistent across species tested and in some cases is indeed dramatic. The level of DDT in bloaters declined some 87 percent between 1969 and 1974. As of 1973, DDT residues in coho salmon had decreased below the 5 µg/gm tolerance level established by the U.S. Food and Drug Administration. Levels in lake trout continued to exceed the standard, however.

Limited information is available on DDT contamination in the other Great Lakes. Data collected in 1973 and 1974 under the Upper Lakes Reference Study indicate that fish of Lakes Superior and Huron contain levels of DDT considerably below the U.S.F.D.A. standard. Similarly, residues in fish from Lakes St. Clair and Erie are apparently low, although only limited data are available. Fish from eastern Lake Ontario were found to contain from 0.75 to 3.81 µg/gm DDT during 1972-73, while fish from Hamilton Harbour averaged less than 1 µg/gm in 1972.

Dieldrin residues in Lake Michigan fish have remained below the U.S.F.D.A. standard of 0.3 µg/gm and show no definite trend (Table 3). Data on dieldrin contamination in the other Great Lakes is limited but suggest that concentrations do not approach the tolerance level.

Mirex, although not used as an insecticide in the Great Lakes region, has been reported in fish tissue from Lake Ontario and should be of concern due to its extreme persistence.

PCB levels have been monitored in some of the Great Lakes since 1970. Residues in Lake Michigan fish (Table 3) show no evidence of a downward trend, remaining close to those reported in the earliest tests. Levels are well in excess of the U.S.F.D.A. standard of 5 µg/gm. The data raise concern for human health implications and for possible adverse effects on fish reproduction.

High concentrations of PCB's have also been reported for fish from Lake Ontario. Trout and salmon species taken from the eastern end of the lake in 1972 contained from 5.05 to 12.85 µg/gm while shad (alewives) contained 4.4 µg/gm.

Available data for Lakes Superior and Huron suggest that PCB residues in fish are considerably below the tolerance level of 5 µg/gm. Levels in Lakes Erie and St. Clair are extremely variable, the highest residues being found in carp (9.3 µg/gm) and channel catfish (4.8 µg/gm). No assessment of trends is possible for these lakes because of the lack of a continuous data series.

Contamination by chlorinated hydrocarbons has also been reported for birds on the Great Lakes. Herring gull eggs on Lake Ontario were found to contain high levels of PCB and metabolites of DDT. The degree of contamination is correlated with the low breeding success of herring gull colonies in this area which is only one-tenth that of the success of less contaminated colonies on the Atlantic coast. The results indicate a need for expanded monitoring of contaminants in wildlife, as well as fish, on the Great Lakes.

TABLE 3

MEAN CONCENTRATIONS OF CHLORINATED HYDROCARBONS IN LAKE MICHIGAN FISH

Year	Species	Total DDT (µg/gm)	Total PCB's (µg/gm)	Dieldrin (µg/gm)
1969	Bloaters	9.94	-	0.27
	Lake trout	-	-	-
	Coho salmon	11.82	-	0.21
1970	Bloaters	9.87	-	0.19
	Lake trout	19.19	-	0.27
	Coho salmon	14.03	-	0.12
1971	Bloaters	6.24	-	0.27
	Lake trout	13.00	-	0.20
	Coho salmon	9.85	-	0.11
1972	Bloaters	4.33	5.66	0.18
	Lake trout	11.31	12.86	0.20
	Coho salmon	7.17	10.93	0.13
1973	Bloaters	2.09	5.24	0.28
	Lake trout	9.96	18.93	0.27
	Coho salmon	4.48	12.17	0.09
1974	Bloaters	1.34	5.46	-

PROPOSED IJC WATER QUALITY SURVEILLANCE PROGRAM

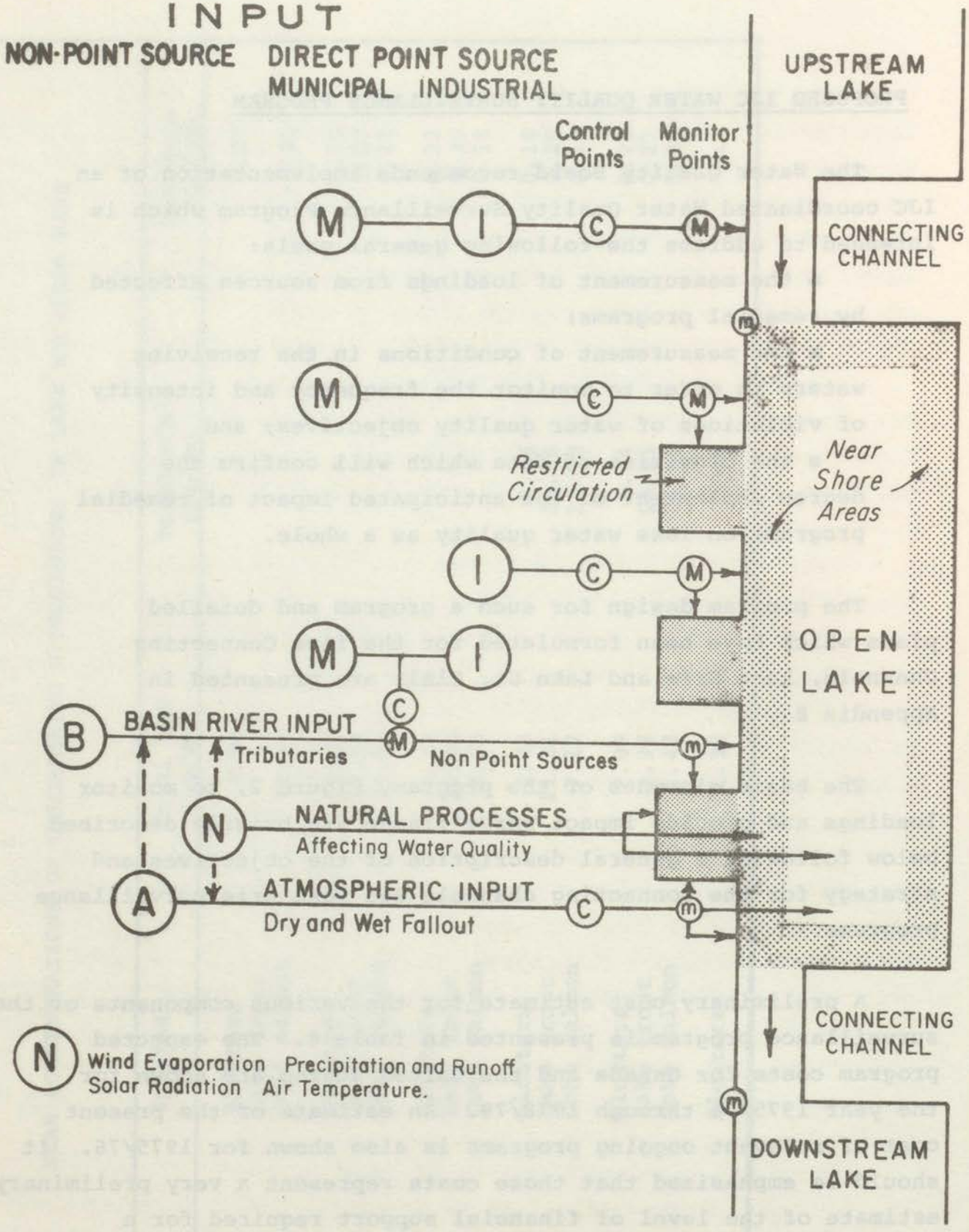
The Water Quality Board recommends implementation of an IJC coordinated Water Quality Surveillance Program which is intended to address the following general goals:

- the measurement of loadings from sources affected by remedial programs;
- the measurement of conditions in the receiving waters in order to monitor the frequency and intensity of violations of water quality objectives; and
- the provision of data which will confirm the degree and extent of the anticipated impact of remedial programs on lake water quality as a whole.

The program design for such a program and detailed plans which have been formulated for the five Connecting Channels, Lake Erie and Lake St. Clair are presented in Appendix B.

The basic elements of the program, Figure 2, to monitor loadings and provide impact surveillance are briefly described below following a general description of the objectives and strategy for the connecting channels and Lake Erie surveillance programs.

A preliminary cost estimate for the various components of the surveillance program is presented in Table 4. The expected program costs for Canada and the United States are shown for the year 1975/76 through 1978/79. An estimate of the present cost of relevant ongoing programs is also shown for 1975/76. It should be emphasized that those costs represent a very preliminary estimate of the level of financial support required for a comprehensive surveillance program for the Great Lakes based on a detailed plan developed for Lake Erie. They will need to be refined considerably as detailed programs are developed for the other lakes.



LAKE LOADING SYSTEM

SCHEMATIC DIAGRAM

FIGURE 2

TABLE 4

SURVEILLANCE PROGRAM COST ESTIMATES

(Thousands of Dollars)

		1975/76 Ongoing	1975/76 Program Level	1976/77 Program Level	1977/78 Program Level	1978/79 Program Level
Whole Lake[1]	Can.	450	550	750	780	820
	U.S.	400	440	990	1310	1440
Near Source[2] and Near Shore	Can.	670	670	710	780	885
	U.S.	100	930	1020	1120	1230
Connecting[3] Channels	Can.	440	340	390	510	460
	U.S.	110	360	440	400	540
Water	Can.	20	180	200	220	240
	U.S.	35	310	340	370	410
Tributary[4] Measurements	Can.	180	260	285	315	345
	U.S.	180	250	275	305	335
Atmospheric Loading	Can.	70	95	80	85	95
	U.S.	10	115	90	95	105
Wildlife	Can.	100	100	100	100	100
	U.S.					
Fisheries		Program being developed - A number of potential components in operation already, but not yet integrated into a program.				
TOTALS	Can.	1930	2195	2515	2790	2945
	U.S.	835	2405	3155	3600	4060

See Footnotes Next Page.

Table 4 cont'd (Footnotes)

(1) The Whole Lake program includes:
    (a) estimates of annual programs for all lakes
    (b) estimates for special surveys
    (c) estimates for data management and analysis
    (d) estimates for remote sensing operations
    (e) funds allocated by the United States for a three year baseline study of Lake Michigan commencing in 1976/77

(2) Near Sources Monitoring estimates are based upon a four year cycle for the Lower Lakes and Lake Michigan (two intensive sampling years and two years at a reduced level) and a six year cycle for Lakes Superior and Huron (two years intensive and four reduced). The program is initiated with intensive years in Lakes Huron and Erie in 1975/76.

    A number of municipal programs for waterfront surveys in the United States are in existence for which cost figures have not been included.

(3) The figures indicate a sediment and biological survey undertaken each year on one specific channel in the following order: Detroit River (1976/77); St. Clair River; Niagara River; St. Lawrence River; and the St. Marys River. It should be noted, due to the detailed planning and logistics involved in surveys of this nature, that slippage of one year may result.

    The estimates for 1975/76 include a special loading study on the Detroit River.

(4) Ongoing funds do not necessarily reflect total actual expenditure due to the difficulty of assessing the cost of flow measurement.

Connecting Channels

The specific objectives of the connecting channels surveillance program are:

- to monitor the water quality of the connecting channels of the Great Lakes System in order to determine compliance with the water quality objectives established in the Great Lakes Water Quality Agreement;
- to investigate and determine the fate of contaminants in the connecting channels;
- to determine trends in the water quality of the connecting channels in order to provide information relevant to the need for, or assessment of, remedial programs; and
- to accurately determine loadings for the connecting channels in order to calculate material balances at the head and mouth of the connecting channels for the Great Lakes.

In order to achieve these objectives a standard list of 33 parameters has been selected to include monitoring for normal parameters plus nutrients, coliforms, organics, trace metals and toxic substances at various ranges on all the channels. At present, the channel plans exhibit a lack of uniformity with regard to sampling frequency and the best mathematical approach for loading calculations. A pilot study has been initiated on the Detroit River to address these issues.

Lake Erie

The strategy for Lake Erie, which may be extended to all lakes, entails eight specific components. The components dealing with the loading aspect include tributary monitoring, atmospheric precipitation monitoring and the monitoring of direct municipal and industrial discharges.

The components addressing the impact aspect of surveillance include whole lake monitoring, near source monitoring, water intake monitoring, fish monitoring and wildlife monitoring.

Monitoring of Loadings

Tributary Monitoring. The tributary monitoring program calls for the monitoring of all tributaries previously listed as significant by the jurisdictions. For the Great Lakes Basin this involves a total of 150 tributaries (this includes 16 tributaries to the connecting channels). At present the basic frequency of sampling will be monthly (except for flow, which will be continuous) for a standard list of 21 parameters. In addition fourteen parameters will be monitored on a semi-annual basis.

Due to the uncertainty in the present monthly strategy for loading assessment, this program will be active for two years while pilot studies assess the optimum sampling frequency, the optimum method of loading calculation and the effects of the suspended solids and bed load on water quality. The results of these pilot studies will be used to modify the strategy for tributary monitoring.

Atmospheric Monitoring. The program will consist of two types of sampling for wet deposition (rainfall and snowfall) and for dry deposition (particulate fall-out). Twenty to twenty-two wet deposition sampling stations are proposed for the entire Great Lakes basin spread approximately uniformly in the basin. Monthly integrated samples of rainfall and snowfall will be collected and analyzed and wet deposition rates calculated for nutrients, trace metals and some major ions.

Air particulate samplers will be located at about six of the wet deposition stations to sample suspended particulate material in the air. Essentially the same parameters will be monitored and dry deposition rates estimated.

Municipal and Industrial Loading. Programs to monitor municipal and industrial loadings from direct discharges to the Great Lakes system are already in existence and information from these programs will be used to supplement the surveillance program. No cost has been estimated for this section of the surveillance program since it is assumed the cost is absorbed by the industries, municipalities and enforcement agencies involved.

Impact Surveillance

Whole Lake Monitoring. Generally, surveillance of all lakes will be carried out on an annual basis with intensive survey years for each lake occurring once every five years for Lakes Ontario, Erie and Michigan on a rotating basis. Longer periods between intensive survey years will be considered in Lakes Superior and Huron since changes may be slower in the main body of these lakes. A cost increase will occur in the year prior to the intensive one, for each lake, in biological sampling to provide two years of biological data within each of these more intensive components.

Specifically for Lake Erie, the annual plan will monitor the oxygen depletion rate and the severity of dissolved oxygen depletion, as well as the areal coverage of the depletion. In addition the phosphorus budget and total dissolved solids trends will be examined. This program involves the monitoring of seventy-five stations during a minimum of eight cruises (four in the summer months, two in

the spring and two in the fall). At each station a maximum of six depths will be sampled if a thermocline exists.

For Lake St. Clair the proposed surveillance program consists of several phases:

- Periodic monitoring at selected water intakes.
- An intensive survey every five years during which a network of stations will be sampled a minimum of twelve times including depth samples. Parameters include the water intake parameters plus seston, zooplankton, phytoplankton, total plate counts, dissolved oxygen and TOC.
- Sediment chemistry and benthos mapping will be carried out in conjunction with the intensive survey years to detect accumulation of pollutants in sediments and monitor the biota of the lake.

Near Source Monitoring. The specific objectives of the near source monitoring program include; the determination of the extent of areas of non-compliance with the general and specific water quality objectives of the Agreement adjacent to major waste sources and identify sources contributing to this violation; and the provision of the basic data needed to examine trends in water quality for areas subject to the influence of specific waste sources.

Basically monitoring will be undertaken in the vicinity of major metropolitan areas and the mouths of tributaries which provide large loadings to the lakes system. Approximately five to fifteen stations will be monitored at a frequency of five to fifteen times per year. The actual sampling station array and parameters will be established by the applicable jurisdiction.

Water Intakes. Water supply intakes will be sampled to provide supportive data to the 'whole lake' program during the years when the whole lake monitoring is done at reduced levels. Intakes will also be sampled to provide year round water quality information.

Eleven intakes have been selected for Lake Erie to be monitored on a weekly basis for approximately fifteen parameters. An additional fourteen parameters will be sampled on an annual basis.

It is assumed that the same intensity of sampling and number of intakes will be used for surveillance in each of the remaining Great Lakes.

Fisheries Program. Contaminants entering the Great Lakes are found in lake biota at concentrations greater than in the water itself. Biota concentrate these materials further at each stage of the food chain. Thus, predatory fish at the higher trophic levels have higher concentrations of these contaminants. These concentrations are more amenable to accurate measurement and thus present a convenient point of focus for impact surveillance.

Fish are a valuable resource in the Great Lakes and must meet food quality standards. In addition, in order that fish stocks be maintained at desirable levels, a surveillance program directed at elements of the biological significance of the contaminants should be addressed.

It has been advised that officials of Canada and Ontario are undertaking a review and summary of existing research and inspection data, as a preliminary to specification of such a program.

Wildlife Program. As in the case of fish at higher trophic levels, contaminants are found in aquatic birds. Great Lakes Herring Gulls have amongst the highest concentrations of numerous organochlorine contaminants of any wild bird populations. It is proposed that measurement of annual trends of toxic chemicals in herring gull eggs be carried forward through collection of 10 eggs to each of two sites on each lake. Negotiations are underway to arrange for collections from Lake Michigan so that all lakes will be covered.

The biological significance of these toxic contaminants will be studied through monitoring of productivity.

MUNICIPAL POLLUTION ABATEMENT

In previous annual reports, the Water Quality Board recommended measures to improve implementing programs directed largely toward control of long-standing pollution from point sources. Emphasis was given to completion of municipal sewage treatment programs and their supporting financial base. This chapter is an update of those program areas. Detailed information is contained in Appendix C.

MUNICIPAL WASTE TREATMENT

Progress of municipal wastewater treatment programs has been addressed in terms of major projects under construction or completed during 1974. Projections of expected completions during 1975 have also been made. In order to establish the relative magnitude of the on-going municipal programs, project completions are related to the populations served.

There are some important differences in the current programs of each country which should be noted. Canada has completed most of its major municipal construction facilities required to provide adequate treatment by 1975 under the terms of the International Agreement. Primary attention has now shifted towards treatment plant expansion to accommodate future growth. On the other hand the United States program is of greater magnitude, and while many projects have been initiated, construction of several major projects will not be completed by 1975. Most of the delays have been associated with the implementation of the stringent

requirements of the Water Pollution Control Act Amendments of 1972 (Public Law 92-500). By 1977 much of the backlog of sewage work construction is expected to be well advanced.

UNITED STATES

In its second Annual Report, the Board reported that 35 percent of the U.S. sewered population was provided with adequate treatment as of 1973. Progress has been made since that time. During 1974, 25 projects each serving communities in excess of 2,500 people were completed. The majority of these projects provided for an upgrading of existing plants to secondary treatment. Collectively, these projects serve about one and a half million people. As a result, the population served by adequate treatment increased to seven (7) million over the year. As of December 1974 adequate treatment is being provided for forty-six (46) percent of the 1971 estimated sewered population of 15.3 million.

In addition to the above, sixty-two (62) projects are expected to be completed and provide adequate treatment for an additional 2.3 million people by the end of 1975. This means that a total of 9.2 million people, or sixty (60) percent of the sewered population in the U.S. Basin will be provided with adequate treatment by December 1975.

CANADA

In Ontario by the end of 1974, seventeen (17) sewage treatment projects were completed. This included six (6) new municipal projects and the upgrading or enlargement of eleven (11) others. Projects completed in 1974 increased

the portion of the population served by adequate treatment to 85 percent of the estimated 1971 sewered population in the Ontario portion of the Great Lakes Basin of 4.8 million persons.

In addition twenty-two (22) construction projects were started in 1974, of which seventeen (17) are expected to be completed in 1975. A number of these are projects required to accommodate growth and they will augment the population served with adequate treatment by 350,000 persons. Five of the twenty-two (22) projects earlier expected to be completed by 1975 will be delayed into 1976. Thus, 97 percent of the 1975 sewered population in the Ontario portion of the basin will be served with adequate sewage treatment by the end of that year.

In five municipalities in the Toronto-Burlington area, where population continues to increase rapidly and additional sewage treatment capacity is marginal, staged programs of sewage works improvements have been planned to accommodate increased demands for sewage service. A number of these municipalities presently served with adequate treatment facilities are continuing with projects to cope with expected growth and upgrade facilities. In the City of Toronto combined sewer problems are being gradually corrected.

Status of Projects

Difficulties encountered in the United States in implementing the complex requirements of PL 92-500 have led to many project delays. This means that completion of eleven major projects serving 6.3 million people will now be deferred beyond 1975. In 1973 major projects at Detroit, Cleveland,

Buffalo, Niagara Falls and Duluth serving 5.3 million people were reported as delayed. Further project delays occurred in 1974 at Gary, Euclid, Tonawanda and Syracuse.

In Ontario, delays anticipated in 1973 involved three projects in the upper lakes basin serving 110,000 people with the major project involved being Thunder Bay. Five project completions at Marathon, Midland, Parry Sound, Trenton and Iroquois, serving a total of 34,000 persons, will be delayed into 1976.

The major cities with delayed projects are listed in Table 5 together with their sewered populations and anticipated completion dates. In the paragraphs below, each facility is discussed as to its current status, progress during the past year, reasons for delays and any revisions to the anticipated completion dates.

Detroit, Michigan (Metro)

The Detroit Metro Plant serves in excess of 3 million people in Detroit and surrounding areas. The present flow averages 900 million gallons a day (MGD), or 3420 megalitres per day (ML/D). Construction has been completed on facilities to provide secondary activated sludge treatment with pure oxygen for 1140 ML/D (300 MGD). The remaining 2280 ML/D (600 MGD) receive only primary treatment prior to discharge. Chemicals are added to all 3420 ML/D (900 MGD) of the incoming flow to remove about 60 percent of the phosphorus content.

TABLE 5

STATUS OF MAJOR PROJECT DELAYS

Facility	Sewered Population	Anticipated Completion Dates	Current Project Costs (Millions of Dollars)
United States			
Detroit, Mich.	3,129,000	1979 (phased construction)	121.4
Duluth, Minn. (Western Lake Superior Sanitary District)	126,000	1977	84.5
Gary, Indiana	175,400	1977	34.0
Cleveland, Ohio (Westerly)	250,000	1979	90.0
(Easterly)	700,000	expansion for advanced treatment planned	10.0
(Southerly)	635,000	1981	180.0
Euclid, Ohio	71,550	1977	12.0
Niagara Falls, N.Y.	102,400	1976	63.0
Tonawanda, N.Y. (Sanitary District No.2)	107,700	1978	62.0
Syracuse Metro, N.Y.	287,600	1979	108.0
Buffalo, N.Y.	750,000	1978-79	158.0
Canada			
Thunder Bay	106,000	1977	10.7

It is anticipated that by September 1975, additional facilities will be completed to provide secondary treatment to a flow of 1710 ML/D (450 MGD) and 80 percent phosphorus removal for the entire flow.

Major treatment units are either under construction or will be placed under construction in 1975 with an estimated completion time for early 1979. Completion of this phase will bring the total design capacity to 4000 ML/D (1050 MGD) with secondary treatment.

The sludge from the Detroit Metro Plant is dewatered, incinerated and landfilled. There were six sludge incinerators in operation in March with eight more expected to commence operation by mid-summer 1975. The plant has experienced difficulties due to the limited sludge handling capacity. The interim solution has been to recycle portions of the sludge back to the primary treatment system with some sludge overflowing to the Detroit River. The situation is expected to improve when the eight additional incinerators come on line. There are plans for further expansion of the sludge handling system in anticipation of achieving the 4000 ML/D (1050 MGD) design capacity in 1979. A sludge handling module including eight more incinerators is to be constructed with contracts to be let in late 1975 or early 1976.

It has been recognized that combined sewer overflow presents a problem. At present there are little quantitative data on the amount and quality of combined sewer overflow. The occurrence of overflow is estimated to be one to two percent of the time. Plans for determining the quality and quantity of the overflow are under consideration at present by the City of Detroit. A detailed plan will be developed by mid - 1975. It is anticipated that preliminary results will be obtained by late 1976 provided sufficient

funding and manpower are available.

Duluth, Minnesota

At present, the Western Lake Superior Sanitary District (WLSSD) is serviced by nine (9) municipal wastewater treatment plants, none of which are providing phosphorus removal. All these plants will be phased out and replaced by a new 167 ML/day (44 MGD) activated sludge treatment plant. Phosphorus will be removed by chemical addition. Total estimated cost for the entire treatment system, including interceptor sewers and sludge handling facilities, is $84.5 million.

Site preparation for this plant is 60 percent complete. Currently, the state is awaiting approval of final construction plans by EPA and subsequent funding. It is anticipated that contract bids will be opened in July 1975, with a construction completion date of mid 1977.

Gary, Indiana

Currently, secondary treatment is being provided by the activated sludge process which achieves a relatively good effluent including phosphorus concentrations between 1.5 and 3 mg/l. Although no phosphorus removal is currently being provided, the levels are relatively low because of the detergent phosphorus ban. The NPDES permit does require interim phosphorus removal (utilizing steel mill pickle liquor) to be implemented by July 1, 1975.

Plans call for plant expansion and phosphorus removal, but delays in starting construction have been encountered due to litigation regarding issuance of bonds for the financing of the necessary construction. A decision by the State Supreme Court is expected shortly and it is anticipated that cons-

truction would begin immediately afterwards. By December 31, 1975 construction should be ongoing on plant expansion and phosphorus removal. Additionally, some sewer regulator works to control overflows will be under construction. Due to the litigation, slippage has occurred and construction is not expected to be completed until April 1, 1977.

Cleveland, Ohio (Westerly)

The Westerly plant is currently providing primary treatment with polymer addition. In 1974, waste pickle liquor was added to the raw sewage for phosphorus removal. The plant is to be expanded to 190 ML/D (50 MGD) with provision to handle a peak load of 304 ML/D (80 MGD). The type of treatment to be provided is physical-chemical with chemical coagulation, filtration and carbon adsorption. Interceptors are under construction and sludge handling facilities are about 25 percent complete and scheduled for completion in late 1976.

The major portion of construction at Westerly has not yet begun. Construction should be underway by the end of 1975. With a planned 52 - month construction period, Westerly should be completed by late 1979.

One of the federal grant conditions for Cleveland requires them to remedy a legal prohibition against imposing user charges on Cuyahoga and Newburgh Heights. The Cleveland Regional Sewer District is seeking relief in the courts.

Cleveland, Ohio (Easterly)

The Easterly Plant is currently providing secondary treatment. The sludge from this plant is piped to Southerly for disposal. The Sewer District is constructing a pilot

plant operation, a decision will be made on whether full advanced treatment is needed.

One major operational problem experienced by the plant is the high lake level at the outfall. The lake level in that vicinity often exceeds the elevation of the secondary overflow weir by several inches. The District is planning to construct effluent pumping facilities.

Cleveland, Ohio (Southerly)

The Southerly Plant currently has secondary treatment. Phosphorus removal has been achieved for the normal dry weather flow due to the high iron concentrations in the influent. At present, pickle liquor is added to the influent whenever available. Construction has not yet begun on expansion and advanced waste treatment facilities, which are an additional requirement. However, a contract was let in late 1974 and provided no major delays are caused by environmental impact assessment, construction should be completed by 1981.

Euclid, Ohio

Present treatment is primary. Proposed treatment will consist of a pure oxygen activated sludge system plus phosphorus removal using aluminum sulphate. As of April 1975, 5 percent of the grant monies has been expended. Construction has just recently commenced. It is anticipated that construction will be completed by 1977.

Niagara Falls, N.Y.

The city is in the process of carrying out a program to upgrade its present inadequate sewage treatment facilities to provide physical-chemical treatment (equivalent of secondary),

plus phosphorus removal.

This plant is designed to treat 182 ML/D (48 MGD) of municipal-industrial wastewater by a physical-chemical process which includes phosphorus removal and carbon adsorption. Plant design was based on 70 percent removal of phosphorus starting with an influent concentration of 2.4 mg/l. It is anticipated the project will be completed in September of 1976. Efforts are being made to speed up the construction so that the plant could be dedicated on July 4, 1976.

During the construction of the new facilities, the screened and chlorinated raw waste will continue to be discharged to the Niagara River.

Feasibility of installing temporary phosphorus removal facilities was investigated by the municipality and it was concluded that the construction of such facilities would not be cost effective and in fact would slow the completion of permanent secondary treatment facilities. Furthermore, there is a phosphate ban in detergents that limits the influent phosphorus concentration.

Tonawanda, N.Y. (Sanitary District No. 2)

A secondary sewage treatment plant is already under construction at a total cost of about $65 million. The plant will be built utilizing some components of the existing primary sewage treatment plant, i.e. sludge handling equipment, an eighteen million gallon retention basin and another retention basin which will use the existing primary tanks, pump stations, force mains, and interceptor sewers. Secondary treatment will be activated sludge followed by metallic salt precipitation of phosphorus and rapid sand filtration. Delays were experienced earlier when several attempts at

including the City of Tonawanda and Spaulding Fibre were unsuccessful. This has now been achieved and also includes Sanitary District No. 5 (Kenmore). Construction is expected to be completed by January 1978.

Syracuse, N.Y. (Metro)

Existing treatment is primary which will be upgraded from 190 ML/D (50 MGD) to a 304 ML/D (80 MGD) activated sludge plant with phosphorus removal. Contracts were awarded in February and the project is now on schedule. The target date is for February 1979. Recent delays stem from the unusual amount of time consumed in preparation of an Environmental Impact Statement and associated hearings. Infiltration and combined sewer problems have further complicated the situation. A rehabilitation program is underway to eliminate all excessive infiltration, and in 1971, EPA awarded Onondaga County a five year research and demonstration grant to examine the combined sewer overflow problem.

Buffalo, N.Y.

The Buffalo Sewer Authority is in the process of carrying out a program to upgrade its present primary sewage treatment plant to provide secondary treatment plus phosphorus removal. During the construction of the new facilities the existing primary treatment plant and chlorination facilities will continue to operate. Interim phosphorus removal during construction has been considered and found to be not feasible.

The total project is being carried out under five separate contracts. Delays were experienced in connection with the site preparation contract when the bid award was contested and went into litigation. This will result in

delaying subsequent contracts. Litigation is also anticipated in connection with the mechanical portion of the sludge disposal contract but this should not substantially delay another contract. Project completion was targeted for 1978 but may stretch over into early 1979.

City of Thunder Bay, Ontario

An accelerated program of sewage works funding by the federal and provincial governments has made possible the rapid development of a multi-year program for construction of trunk and interceptor sewers to collect all remaining sewage flows for treatment.

Previously scheduled for construction over the next five years, the overall project is now expected to be completed before March 1977. Construction of the 109 ML/D (24.0 MGD) (Imperial) primary waste treatment plant without phosphorus removal which will replace the existing two plants will commence in 1975 for completion by 1977. The adequacy of such treatment is under review in the Upper Lakes Reference Study.

Expenditures

Construction funds made available by the various governmental agencies in support of both the U.S. and Canadian municipal treatment programs have been summarized in Table 6 for 1971 through 1974. The Table reflects a steady increase of funds committed to municipal programs by both countries.

Funds approved for sewage treatment and trunk sewer construction in Ontario over the period 1971 - 1974 totalled $415 millions. By 1975 additional expenditures in excess of

TABLE 6

ANNUAL FUNDS (NON-CUMULATIVE 1971 TO 1974) COMMITTED FOR SEWERAGE CONSTRUCTION IN THE GREAT LAKES BASIN. (MILLIONS OF CURRENT DOLLARS)

Year	Total Spending by all Levels of Government in Canada (1)	Obligated State and Federal Funds in the United States (2)
1971	45	370
1972	57	313
1973	153	419
1974	160	509

(1) For Canada, figures represent the total approved sewage works Capital expenditures (treatment and trunks)

(2) Figures represent total U.S. eligible project costs with Federal grant approval.

$120 millions are expected for sewage treatment and trunk sewer construction. The value of construction remaining to overcome the backlog of works in Ontario which will not be completed by 1975 will exceed $20 million. In order to maintain the adequacy of present programs, some $300 million in total spending will be required in 1976 and 1977. In the U.S., funds obligated for sewerage works from 1971-74 totalled about $1.6 billion.

Considerable concern was expressed over the impoundment of construction funds appropriated by the U.S. Congress for the Great Lakes States in meeting the 1975 needs. Nine billion dollars of the $18 billion appropriated for FY 73 through FY 75 were impounded by the U.S. Executive Branch. Failure to release these funds and accelerate the procedures for processing and approving grant applications could have seriously delayed the planned U.S. municipal program.

On January 24, 1975, the President released $4 billion of the impounded funds for the construction grant program. Recently, as a result of the February 18, 1975 Supreme Court decision, EPA has allocated an additional $5 billion from withheld funds. Therefore the entire $18 billion authorized by Congress in the Federal Water Pollution Control Act Amendments of 1972 for FY 73, FY 74 and FY 75 is now expected to be obligated by September 1977.

All current funds authorized by Congress through Fiscal Year 1975, including the $9 billion of released funds, will have an impact on 174 projects in the U.S. Great Lakes Basin serving an estimated two (2) million people. Eighty-three (83) of these projects will have been awarded Step III grants (Construction phase funds) by the end of 1975. A state breakdown of these grant awards served is shown in Table 7. Those grant awards include treatment facilities and interceptor sewers.

STORMWATER AND COMBINED SEWER OVERFLOWS

Stormwater and combined sewer overflows have been identified as a major problem in most of the urban areas in the Great Lakes Basin. Major problem areas, as detailed in Appendix C, generally display water quality problems associated with stormwater and combined sewer overflows. Under the terms of the Agreement, the Parties are to find practical solutions for reducing pollution from overflows of combined storm and sanitary sewers. The following paragraphs describe the activities in the Great Lakes Basin.

UNITED STATES

The U. S. program has emphasized the development and demonstration of specific technological alternatives in stormwater management including abatement systems and storage/treatment controls. Specific technological solutions have been implemented in a number of Great Lakes Basin urban areas. As a national policy, all dischargers with combined sewer systems are required, through their NPDES permits, to obtain information

TABLE 7

ADDITIONAL TREATMENT FACILITIES* IN THE U.S. GREAT LAKES BASIN EXPECTED TO BE FINANCED WITH AVAILABLE FUNDS

State	Estimated Number of step 3 grants** awarded by December 31, 1975	Number of Step 3 grants awarded after December 31, 1975	Estimated Cost (Millions of Dollars)
Illinois	Diverting Out of Basin		130
Indiana	1	3	37
Michigan	46	35	354***
Minnesota	1	5	87
New York	31	13	218
Ohio	18	11	120
Pennsylvania	2	5	8
Wisconsin	1	2	19
TOTAL	100	74	973

* Does not include projects already under construction.

** Step 3 Grant is Construction Phase.

*** Project Costs for Michigan include only those projects which are expected to receive grants by December 31, 1975.

on the quantity, quality and impact of combined sewer overflows on the respective receiving waters. This and related information must be sufficient to develop a subsequent program for corrective action including a schedule for implementation.

In order to estimate the cost of construction needed to meet the 1983 goals of the Federal Water Pollution Control Act Amendments (FWPCA) of 1972, a "Needs" Survey was conducted by the state and EPA. The Survey covered several categories of which the Control of Combined Sewer Overflows was included and it was estimated that approximately 6 billion dollars would be required to prevent periodic bypassing of untreated wastes from combined sewers.

CANADA

Under the coordination of the Canada-Ontario Agreement on Great Lakes Water Quality, Canadian activity is centered on development of a control strategy covering all aspects of urban drainage management and includes both storm and combined sewer overflows. The development program has three parallel activities in progress: estimation of the extent of stormwater discharges and combined sewer overflows in relation to other water pollution sources within the Great Lakes Basin; development and verification of techniques to estimate quantities and qualities of stormwater runoff and the cost effectiveness of treatment alternatives; and to review existing policies of other governments and agencies in order to adapt them to the legislative and financial framework in the Great Lakes Basin. The cost of the development program, now 60 percent complete, will be in excess of one million dollars.

SLUDGE DISPOSAL OR UTILIZATION

The disposal or utilization of sludge from wastewater treatment plants is a very significant component in the overall treatment process. The sludge, highly concentrated in organics, heavy metals and nutrients, can create severe pollutional problems if improperly handled.

Quantities of sludge resulting from sewage treatment have increased greatly where chemicals for phosphorus removal are added. Methods of disposal of sludge in common usage in the Great Lakes Basin are incineration, landfill, lagooning, and agricultural applications, depending on a number of economic, social and environmental factors. These methods have led to a number of specific problems for which individual jurisdictions have provided short term remedial measures.

In summary, sludge disposal remains a very significant problem in the overall environment. As more phosphorus removal facilities are installed in municipal treatment plants within the Basin, more sludge will be produced. Some municipalities in Ohio have been forced to curtail the addition of chemicals for phosphorus removal due to an inability to handle the increased volumes of sludge produced. While all the jurisdictions are cognizant of the sludge disposal problems, and the necessary long term remedial measures, the Province of Ontario and the State of Minnesota have taken definitive steps towards this goal by way of their Resource Recovery Program which include financial assistance to municipalities.

EUTROPHICATION AND PHOSPHORUS CONTROL

Programs for the control of eutrophication of the Great Lakes through the reduction of phosphorus inputs are progressing both in Canada and the United States. Loadings from municipal sources have been substantially reduced through implementation of programs to remove phosphorus from sewage treatment plant effluents. Additionally, three states and Canada have legislation limiting the content of phosphorus in detergents.

The compilation and evaluation of reported phosphorus loading data once again indicates serious deficiencies in estimates of total phosphorus loadings to the lake. Data collected in 1974 indicate that base loadings specified in the Agreement may have been low. Tributary data reported for the 1974 water year also appear to be incomplete and biased on the low side because of inadequate sampling programs. Inadequate data bases for both direct dischargers and tributaries make accurate assessment of changes in total phosphorus loadings to the lakes difficult, and limit the usefulness of predictive models being developed to help determine the effect of phosphorus control programs on future levels of algal biomass.

This section highlights significant information regarding phosphorus reduction programs, phosphorus loadings, and the effectiveness of phosphorus reduction. More detailed information is contained in Appendix C.

The phosphorus removal program for municipal dischargers is progressing well. The effect of this program is evident in the reduced phosphorus loadings from direct municipal sources in all the Great Lakes except Lake Michigan (Table 8). Lake Michigan's increased loading may be attributed to actual reported loadings from Wisconsin as compared to estimated values from the previous year. However, the 1974 reported phosphorus loadings from tributaries have generally increased throughout the entire Basin with the most notable jump in Lake Erie.

In Lake Erie, the direct municipal phosphorus loading decreased from 28,700 kilograms per day (kg/day) to 19,100 kg/day over the last year whereas in Ohio alone, reported tributary loadings doubled from 7,100 kg/day in 1973 to 15,800 kg/day in 1974. The apparent discrepancy arises from the fact that the 1973 loading data from the Maumee River, the largest tributary to Lake Erie other than the Detroit River, were calculated using an average annual phosphorus concentration and average annual flow. The 1974 loading data, on the other hand, were calculated on the basis of four (4) weighted average monthly loadings and as such are probably more representative of the actual loading. Nevertheless, it is still difficult to determine any trends in phosphorus loadings to Lake Erie from the tributaries. There is an urgent need for more representative data.

The decrease in phosphorus loadings from municipal sources in Lake Erie was approximately equal to the increase from tributaries with the result that no net change was reported.

TABLE 8

REPORTED PHOSPHORUS LOADING DATA - 1974

(Kilograms per day*)

Basin	Direct Industrial Discharge	Direct Municipal Discharge	Tributary	Total
Lake Superior	255 (354)	311 (1,046) **	5,467 (3,004)	6,033 (4,404)
Lake Huron	0 (47)	386 (446)	10,052 (6,436)	10,438 (6,929)
Lake Michigan	122 (35)	2,981 (1,218)	13,608 (11,236)	16,711 (12,489)
Lake Erie	346 (771)	19,115 (28,748)	24,556 (13,780)	44,017 (43,299)
Lake Ontario *	324 (598) *	5,358 (6,232) *	5,828 (3,466) *	11,510 (10,296) *
TOTAL	1,047 (1,805)	28,151 (37,690)	59,511 (37,922)	88,709 (77,417)

(1973 reported data shown in parentheses)

All values reported in kilograms/day (kg/d x 2.205 = lb/day)

* 1973 data from Province of Ontario only

** Duluth's loading included in Tributary Loading in 1974 due to relocation of St. Louis River's sampling station.

The status of phosphorus removal facilities in the Great Lakes System is summarized in Table 9. It should be noted that Table 9 only indicates progress achieved in the installation of such facilities. The operating efficiency of these facilities varies from plant to plant. The Board has authorized a study to evaluate operational efficiencies at major treatment plants in the Lake Erie Basin. For the entire Great Lakes Basin, 69 percent of the sewage flow from all direct municipal dischargers and those indirect ones with flows greater than 4 megalitres per day (ML/D) (1 MGD) have phosphorus removal as of December, 1974. By the end of 1975, it is expected that 89 percent of the flow will have phosphorus removal.

In the Lake Erie basin, phosphorus removal facilities were available for 94 percent of the sewage flow as of December 1974. It is estimated that by the end of 1975, this figure will increase to approximately 97 percent. The Province of Ontario has completed implementation of phosphorus removal program while 94 percent of the U.S. Lake Erie flow has phosphorus removal.

For Lake Ontario, it is expected that by December 1975, sewage from all plants with capacities greater than 4 ML/day in the Province of Ontario will be provided with phosphorus removal. No information has been received from the State of New York as to the current status of their phosphorus control program.

There is evidence that the limits placed on phosphorus content in detergents as practised in Canada, Indiana, Michigan and New York have contributed, to some extent, to improvement in tributaries and a decrease in phosphorus loadings. With the implementation of the phosphorus removal program, further improvements should be achieved.

TABLE 9

STATUS OF PHOSPHORUS REMOVAL FACILITIES INSTALLED

Basin		Municipal Wastewater Flow (1974) (ML/D)	Percent by Volume of Municipal Wastewater having Phosphorus Removal Facilities As of Dec. 74	By Dec. 75
L. Superior	U.S.	130	3 %	11 %
	Canada	60	0 %	0 %
	TOTAL	190	2 %	7 %
L. Huron	U.S.	437	50 %	55 %
	Canada	239	70 %	70 %
	TOTAL	676	57 %	60 %
L. Michigan	U.S.	2,870	63 %	75 %
	Canada	-	-	-
	TOTAL	2,870	63 %	75 %
L. Erie	U.S.	6,618	94 %	96 %
	Canada	622	100 %	100 %
	TOTAL	7,240	94 %	97 %
L. Ontario	U.S.	ND	ND	ND
	Canada	2,152	3 %	100 %
	TOTAL	-	-	-
All Five Basins	U.S.	10,055	82 %	87 %
	Canada	3,073	28 %	96 %
	TOTAL	13,128	69 %	89 %

ND - No Data from New York

ML/D - Megaliters per day (ML/D x 0.264 = Million Gallons (U.S.) per Day, and ML/D x 0.220 = Million (Imperial) Gallons per Day

1 - All direct dischargers and indirect dischargers greater than 4 ML/D.

2 - Actual efficiency of phosphorus removal varies from plant to plant.

In Table 10, phosphorus loadings for all municipal dischargers over than 4 ML/day (IMGD) within each basin are summarized. Table 10 will henceforth be used as an ongoing accounting procedure to assess the effectiveness of municipal remedial programs to control eutrophication.

Tables 11 and 12 compare reported phosphorus loadings with target loadings specified in the Agreement for the Lower and Upper Lakes respectively. It should be reemphasized, however, that some base load estimates developed at the time of the Agreement were too low and the tables should be interpreted with this consideration in mind.

The ultimate assessment of the effectiveness of phosphorus reduction programs must be made in terms of the changes in algal biomass in the Great Lakes. As discussed in Appendix B, there are some preliminary indications of improving conditions. Some water intake data on Lake Erie shows declines in nearshore chlorophyll a concentrations. There appears to be some reduction of both phosphorus and chlorophyll a concentrations in open waters of the western basin of Lake Erie. There is no clear indication however, that these changes are due to remedial programs. They may be due to dilution effects due to high water levels. Recent modelling efforts for Lake Ontario indicate that lake response times are in the order of 15-20 years and equilibrium levels of algal biomass have not yet been achieved in open lake waters. The impact of phosphorus reduction programs should be most obvious in Lake Erie due to the relatively short flow through time. It should be noted that current open lake conditions result from phosphorus loads that entered the lakes years ago - possibly 3 to 5 years ago in the case of Lake Erie. With substantial phosphorus reductions occurring during 1973 and 1974, the impact on open lake algal biomass should not be expected to occur until perhaps 1977 to 1979.

TABLE 10

PHOSPHORUS LOADINGS FROM ALL MUNICIPAL DISCHARGERS**

Basin	Population Served	1974 Actual Flow (ML/D)	Phosphorus Loadings (KG/D)
L. Superior	294,800	190	894
L. Huron	941,900	676	1,351
L. Michigan	3,501,500	2,870	7,988
L. Erie ***	7,293,500	7,240	23,495
L. Ontario *	3,915,500	2,152	4,846
TOTAL	15,947,200	13,128	38,574

ML/D - Megalitres per day
(ML/D x 0.264 = Million gallons (U.S.) per day)
and ML/D x 0.220 = Million gallons (Imperial) per day

KG/D - Kilograms per day (KG/D x 2.205 = lb/day)

* Contains only data from Ontario. Data from New York are incomplete.

** Includes all direct dischargers and those indirect dischargers with over 4 megaliters per day capacities.

*** Data from New York not included.

TABLE 11

COMPARISON BETWEEN REPORTED AND TARGET* PHOSPHORUS LOADINGS

TO THE LOWER GREAT LAKES

(Kilograms Per Day)

	1971		1972		1973		1974		1975	
	Reported	Target	Reported	Target	Reported	Target	Reported	Target	Projected	Target
LAKE ERIE										
United States	63,800	63,800	35,390	52,700	41,020	43,000	39,300	31,100	33,570	28,600
Canada	7,900	7,900	5,130	7,900	5,910	7,000	5,080	5,200	4,650	5,500
TOTAL**	77,400	77,400	47,700	66,300	53,890	55,400	52,480	42,300	46,320	40,100
LAKE ONTARIO										
United States	17,100	17,100	15,720	16,200	15,720	16,700	15,720†	13,200	4,210	9,500
Canada	15,600	15,600	12,250	16,100	10,300	12,900	7,230	12,900	7,320	13,100
TOTAL***	44,600	44,600	39,570	44,200	37,320	41,500	32,500	38,000	22,830	34,500

(Kilograms per day x 2.205 = Pounds per day)

* Anticipated "Residual Loads" established in 1972 Great Lakes Water Quality Agreement

** Includes input from Lake Huron

*** Includes input from Lake Erie

† 1972 data from New York used

TABLE 12

COMPARISON BETWEEN REPORTED AND TARGET* PHOSPHORUS LOADINGS TO THE UPPER GREAT LAKES

(Kilograms Per Day)

	1972		1973		1974		1975	
	Reported	Target	Reported	Target	Reported	Target	Projected	Target
LAKE SUPERIOR								
United States	3670	-	3420	3740	3120	3600	3140	3500
Canada	2240	-	1910	2050	2910	2070	2800	2110
LAKE HURON								
United States	3810	-	3680	3600	6730	3480	6720	3540
Canada	3340	-	3710	3110	3720	2970	3880	3040

(Kilograms per day x 2.205 = Pounds per day)

* Anticipated "Residual Loads" established in 1972 Great Lakes Water Quality Agreement

TABLE 12

COMPARISON BETWEEN REPORTED AND TARGET PHOSPHORUS LOADINGS
TO THE UPPER GREAT LAKES
(Kilograms Per Day)

	1972		1973		1979		1979	
	Reported	Target	Reported	Target	Reported	Target	Projected	Target
LAKE SUPERIOR								
United States	3870	3820	3790	3120	3600	3140	3980	3140
Canada	2340	1910	2050	2070	2070	1900	2110	1900
LAKE HURON								
United States	3810	3580	3600	6730	3860	6720	3900	6720
Canada	3940	3340	3940	3070	3940	3070	3940	3070

* Anticipated "Residual Levels" established in 1972 Great Lakes Water Quality Agreement

INDUSTRIAL POLLUTION ABATEMENT

A significant number of problems and problem areas have been associated with discharges from industrial sources, both in Canada and the United States. Continuing concern for abatement of such pollution is evidenced by substantial efforts on the part of Federal, Provincial and State agencies to implement their respective industrial waste control programs. Basic differences which exist between the Canadian and U.S. program approach do not allow for direct comparisons of progress. Nevertheless, program objectives are generally compatible - achievement of best practicable pollution control technology and attainment of water quality consistent with the objectives of the Agreement.

An overview of significant elements of U.S. and Canadian industrial pollution abatement programs follows. More detailed information together with a discussion of programs by industrial category is contained in Appendix C.

UNITED STATES

The National Pollutant Discharge Elimination System (NPDES) Permit Program demonstrated significant progress during 1974 and the first part of 1975. Michigan, Wisconsin, Ohio, Minnesota and Indiana have been granted authority to issue NPDES permits and it is anticipated that Illinois will be requesting program authority in the near future. New York

is expected to receive permit authority by June 1975. No date is currently available as to when Pennsylvania will receive the NPDES program authority. The U.S. EPA is working with Pennsylvania to administer the program. Pennsylvania certifies when a discharge will comply with certain provisions of the law and EPA then issues the permits for that discharge.

In accordance with national goals, all major discharger NPDES permits were to have been issued by December 31, 1974. Major dischargers are those point source dischargers that have been determined by State pollution control agencies and U.S. EPA to have significant impact on water quality either by virtue of large volumes of wastewater or quantities and nature of pollutants or both.

The permits contain two important elements: effluent limitations and a schedule for attaining compliance with those limitations. Each permit lists chemical and physical characteristics of the effluent and specifies average and maximum loadings and or concentrations to be maintained in the effluent. The schedule of compliance specifies dates for such events as submission of plans, initiation of construction, completion of construction, attainment of operational levels etc. Additionally, the permit specifies monitoring and self reporting requirements. Generally, as a minimum, Best Practicable Technology (BPT) is to be achieved by July 1, 1977 and Best Available Technology (BAT) is to be achieved no later than July 1, 1983.

On the U.S. side of the Great Lakes Basin NPDES permits have been issued for 292 of 312 major industrial dischargers. Sixty-six of the 312 dischargers which permits have not been issued are due to challenging the permit conditions

and are in the adjudicatory hearing process. Table 13 summarizes the status of compliance of these dischargers with the permit schedules as of December 1974. The high compliance rate is partially due to the fact that many of these permits were issued near the end of 1974.

Minor industrial permits, which number approximately 2000 in the Great Lakes Basin, are scheduled to be issued by June 30, 1975.

Compliance Monitoring and Enforcement

The major program emphasis is gradually shifting from permit issuance, to compliance tracking, monitoring and enforcement. In addition to tracking compliance by examining self monitoring reports required by the permits, both EPA and the states are conducting compliance monitoring surveys and inspections. This involves sampling of the discharger's outfalls, analysis for chemical parameters that are specified in the permits, and inspection of operating procedures. When violations are uncovered, permit conditions may be enforced by issuing Administrative Orders or through civil and criminal proceedings in court. During 1974, six enforcement actions against industrial dischargers in the Great Lakes Basin were taken by U.S. EPA and twelve by state agencies. The number of such actions undertaken during 1975 is expected to be significantly greater since many permits were not issued until the latter part of 1974.

Due to several persistent problems, the General Point Source File (GPSF) data system is being abandoned in 1975. A simpler, modified data system is being developed and will be adopted in FY-76. However, the new permit compliance data system does not have the capability to retrieve in-

TABLE 13

STATUS OF COMPLIANCE WITH
INDUSTRIAL NPDES PERMIT COMPLIANCE SCHEDULES
(SIGNIFICANT DISCHARGERS)
AS OF DECEMBER 1974

	In Compliance	Out of Compliance	Pending Adjudicatory Hearing or Permit Modification
L. Superior	8	1	2
L. Michigan	98	1	22
L. Erie	64	0	26*
L. Ontario	60	0	16
L. Huron	14	0	0
TOTAL	244	2	66

* 19 in Ohio are not issued.

formation by hydrological basin codes. This system should be modified to provide such capability which is essential in developing remedial programs information.

Effluent Guidelines

During 1974 effluent guidelines were promulgated and became effective for thirty (30) industrial categories. Table 14 lists these categories together with seven additional categories for which guidelines became effective during the first two months of 1975. These guidelines have been utilized in the establishment of effluent limitations in NPDES Permits for specific dischargers. Where water quality standards dictated more stringent final effluent limits were specified.

Toxic Pollutants

On December 27, 1973, effluent limitations for nine toxic pollutants were proposed. The pollutants listed were: Aldrin and Dieldrin; Benzidine and its salts; Cadmium and all cadmium compounds; Cyanide and all cyanide compounds; DDD, DDE and DDT; Endrin; Mercury and all mercury compounds; Polychlorinated biphenyls (PCB's); and Toxaphene.

An advance notice of proposed rule-making was published in May 1975. Following a technical workshop, from which a complete statement of basis and purpose will be completed, another public hearing will be held this summer. It is not expected that final promulgation of these standards will occur prior to October 1975.

TABLE 14

LISTING OF EFFLUENT GUIDELINES PROPOSED AND ADOPTED AS OF JANUARY 28, 1975

CATEGORY	PROMULGATED IN FEDERAL REGISTER	EFFECTIVE DATE
Beet Sugar Processing	1/31/74	4/1/74
Insulation Fiberglass	1/22/74	3/25/74
Electroplating	3/28/74	5/28/74
Feedlots	2/14/74	4/15/74
Plastics and Synthetics	4/5/74	6/4/76
Cement	2/20/74	4/22/74
Organic Chemicals	4/25/74	5/13/74
Iron and Steel	6/28/74	7/28/74
Timber Products Processing	4/18/74	5/23/74
Pulp and Paper	5/29/74	5/29/74
Meat Products	2/28/74	4/29/74
Canned Fruits and Vegetables	3/21/74	5/20/74
Sugar Processing (Cane)	3/20/74	5/20/74
Textiles	7/5/74	7/5/74
Inorganic Chemicals	3/12/74	5/13/74
Soaps and Detergents	4/12/74	6/11/74
Fertilizer	4/8/74	6/11/74
Phosphates	2/20/74	4/22/74
Petroleum Refining	5/9/74	5/12/74
Nonferrous Metals	4/8/74	6/3/74
Steam Electric Power Plants	10/8/74	11/7/74
Ferroalloys	2/22/74	4/23/74
Leather	4/9/74	6/4/74
Rubber	2/21/74	4/22/74
Dairy Products	5/28/74	5/28/74
Grain Milling	3/20/74	5/20/74
Glass	2/14/74	4/15/74
Asbestos Manufacturing *	2/26/74	4/29/74
Seafood Processing	6/26/74	6/26/74
Builders Paper	5/9/74	5/9/74
Thermal Discharges (316 a, b)		
Glass Manufacturing	1/16/75	2/18/75
Rubber Processing	1/10/75	1/10/75
Timber Products Processing		
Meat Products	1/3/75	1/3/75
Asbestos Manufacturing *	1/9/75	1/9/75
Grain Mills	1/3/75	3/1/75
Plastics and Synthetics	1/23/75	2/24/75
Fertilizer	1/13/75	1/13/75

* These guidelines cover different subcategories.

Ontario regulates and controls liquid industrial wastes under the authority of the Ontario Water Resources Act and the Environmental Protection Act. The Province has assumed responsibility for implementation of national regulations and guidelines for industrial wastes under the Canada Fisheries Act. Effluent guidelines and standards are employed to limit the discharge of effluents from individual industrial operations and consideration is given to the impact on receiving water quality. Proposals for industrial waste control are evaluated and engineering plans for waste treatment and control facilities are reviewed for approval. Analyses of environmental impacts of major industrial projects, where proposed, are undertaken cooperatively by both the provincial and federal Governments.

Industry is encouraged to pursue and research alternative waste treatment technologies, including water use conservation, and is actively supported by both federal and provincial financed assistance programs. Where an industry responds to recommendations of the Province, control requirements may be formalized by an exchange of correspondence. In other cases Ministerial or control orders may be issued. Non-compliance with control orders or other requirements may lead to prosecution under either federal or provincial legislation.

Expenditures for pollution control by industries in the basin for the period 1957-1974 amounted to 340 million dollars. Expenditures incurred in construction of facilities for pre-treatment of high strength wastes prior to discharge to municipal systems, and costs of joint municipal-industrial projects are unknown.

Gradual progress is being made in reduction of outstanding problems and on Lake Superior the paper mills are implementing staged programs of control to be completed by 1977.

Surveillance and Enforcement Actions

Surveillance activities involve field inspection of industrial operations and treatment facilities employed by power generation facilities, basic iron and steel producers, petroleum and chemical complexes, food-processing plants, pulp and paper mills, mining and metallurgical operations. Surveillance of sources of radioactivity is conducted in cooperation with the Atomic Energy Control Board and other interested federal and provincial agencies.

A computerized system is under development for review of compliance of industrial discharges with Ministry requirements. Computations are made for monthly loadings and concentrations to facilitate the exercise of control when control limits are exceeded. Under design and going into operation in 1975 is a system to process data describing treatment facilities planned, approved, developed or installed, to permit evaluation of performance with respect to operating criteria, objectives, costs and pollution control effectiveness.

Sixteen prosecutions were initiated in 1974 for violations of the Ontario Water Resources Act.

Effluent Guidelines

The Ministry employs the following guidelines in evaluating industrial operations:

- objectives for the Control of Industrial Waste Discharges in Ontario
- mining guidelines
- metal finishing guidelines
- organic, chemical guidelines (tentative)
- petroleum refining guidelines (tentative)

National effluent regulations and guidelines are employed for the chlor-alkali (mercury only) petroleum refining and pulp and paper industries. Regulations and guidelines are under development for the following industrial classifications:

- chlor-alkali - general
- meat and poultry
- metal plating and finishing
- mining
- organic chemicals
- food and allied industries
- pulp and paper (revisions)
- textiles

Toxic Pollutants

Pollutants toxic to aquatic life are specified under conditions of waste discharge which are based upon exposure of test organisms to the effluents for the following substances:

ammonia
cadmium
chromium
copper
lead
mercury
nickel
tin
zinc

OTHER ACTIVITIES UNDER THE AGREEMENT

In addition to implementing remedial programs to control pollution from municipal and industrial sources the Agreement requires that measures be taken to reduce pollution from land use activities, shipping activities, dredging activities, and onshore and offshore facilities and that a Joint Contingency Plan be implemented and hazardous polluting substances be identified.

LAND USE ACTIVITIES

In its 1973 report, the Commission recommended that governments give early consideration to the control of pollution from land use activities. Most jurisdictions have made significant progress in many aspects of this very complex problem. None have yet developed comprehensive programs with adequate resources to meet the goals envisioned by the Agreement. Programs for environmental assessment of land use activities are under development in all jurisdictions and will be reported on in the next Annual Report.

The Board is still awaiting the responses of the Governments to the early action recommendations and intends to develop an inventory of the availability and implementation of specific program plans including fiscal, personnel and needed regulatory requirements for the six land-use activities listed in the recommendations of the 1973 IJC Report.

The International Reference Group on Great Lakes Pollution from Land Use Activities has published a two-volume report on its U.S. Task A Study. The report presents a state-of-the-art assessment of current U.S. management programs on

land use activities which may affect water quality in the Great Lakes.

The following briefly describes programs used by both countries to manage and control pollution from ten of the broad categories of land use activities.

Urban Land Development and Construction

Urban land development and construction exert a significant non-point source loading of sediments.

The management and control of sediment is not uniform among the various Great Lakes States. Illinois, Indiana, Minnesota, New York, and Wisconsin have not enacted State laws or regulations directed specifically at sediment control. In these States land-use activities that generate loads of sediments which could adversely affect water quality in the area can be abated under general water quality guidelines and regulations. Michigan, Ohio, and Pennsylvania have specific regulatory programs for controlling erosion and sediments. Michigan's program currently deals with all urban and rural activities disturbing more than one acre of land. Pennsylvania has developed a similar program for treating sediments from urban and rural activities. However, Ohio's sediment control program is primarily limited to agricultural lands. New opportunities for addressing water pollution problems resulting from urban land development and construction have become available under the Areawide Waste Management Planning Program authorized under Section 208 of PL 92-500. The National Environmental Policy Act of 1969 also offers further opportunities to control adverse environmental impacts of land development and construction related to federal or federally sponsored activities.

In Ontario, land development and construction practices

are controlled by local municipalities. The Province advises municipalities concerning control of erosion and sediments and employs guidelines for utility and other major construction projects where environmental factors are of concern.

Agriculture

Animal Wastes

In recent years there has been a move towards adopting concentrated animal feedlots practices for various types of animal production operations in the Great Lakes Basin. These operations have resulted in significant loads of animal wastes in concentrated form which can present serious non-point runoff of biodegradeable material.

Although the EPA has established guidelines applicable to feedlots within certain sizes of operations under the NPDES Program, most States have not provided any regulations or control procedures to limit or handle the resulting animal wastes.

The major regulatory activities at the State level have been in Minnesota, Illinois, and Indiana, where intensive animal feedlots have, in the past, posed serious problems to water quality. Other States are regulating their intensive animal feedlots through general water quality statutes, the NPDES permit program, and regulations preventing water quality deterioration on the part of land-use activities. Areawide Water Management Planning under Section 208 of PL 92-500 will provide further opportunities for the States to regulate feedlots.

In Ontario the Agricultural Code of Practice provides guidelines regarding the minimum area of land required for manure disposal in terms of animal units and soil types and

indicates requirements for manure handling systems and management practices. Where normal farm practices are not followed a four-member Farm Pollution Advisory Committee, which is appointed by the Ministers of Agriculture and Food and the Environment, assists the operators involved in improving their methods for handling livestock wastes.

Nutrients and Sediments

Considerable research and guidance on fertilizer use and soil conditions is made available to interested farmers by staff at the University of Guelph, Ontario Ministry of Agriculture and Food, and Canadian Department of Agriculture and on the U.S. side by the United States Department of Agriculture Soil Conservation Service and the U.S. EPA.

The control of sediment losses is important because it relates directly to the movement of pesticides and nutrients as well as the siltation of reservoirs and harbours. Local conservation authorities and agricultural representatives have been active in providing assistance to farmers in implementing programs to reduce soil loss from erosion and sedimentation. In Ontario guidelines are employed for crop cultivation to encourage soil conservation.

Pest Control Products

In its 1973 Report, the Commission recommended to the Governments that systematized pest control product use inventory programs should be established in the Great Lakes Basin by the appropriate jurisdictions.

Currently all Basin States require registering of commercial pesticides and regulate the distribution of restricted pesticides by regulating transport methods, retail and wholesale sales, and distribution of permits.

Few States have statutes aimed at regulating pesticides' and herbicides' water quality impacts except in the area of their disposal.

State management and control of pesticides range from outright banning of certain pesticides, mainly the chlorinated hydrocarbons, to restricting areas of pesticide usage. Most States do not regulate household pesticide applications, limiting their regulations and procedures to commercial applications.

In the United States, the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) amendments of 1972 require that a program for the certification of applicators using pesticides designated for "restricted" use be operational by October, 1976. State agencies have the primary responsibility of applicator certification. Plans for the administration of the program are being developed by State agencies according to Federal Standards. They are subject to approval by EPA. The certification programs will apply to both private (farmers, ranchers, etc.) and commercial applicators. It is anticipated that the necessary state legislation will be adopted shortly and that plans will be developed soon thereafter. In late 1975 the States will begin certifying applicators under a program scheduled to be completed by October 1976.

Pest control products in Canada are regulated under Federal Pest Control Products Act (1969). This Act is administered by Agriculture Canada and regulates almost all of the products used by home-owners as well as those used by government agencies. Unduly persistent environmentally active compounds have been either banned or severely restricted in use. Any material for direct application to water is classified as a restricted compound. This means that before use a permit must be granted by the provincial authority.

In Ontario, the sale and use of pesticides is rigidly controlled by the Pesticides Act. Registered pesticides are classified on the basis of toxicology and potential environmental impact. The very toxic and persistent as well as commercial and agricultural pesticides are available only on a specific-use permit and the vendors are required to keep complete sales records. Sampling for toxicants is conducted regularly of milk, avian fat, beef fat, eggs and soils and the information disseminated quickly to horticulturalists and agriculturalists.

Transportation

There are many roads, municipal airports, and intrastate utility lines, which in the aggregate may be significant non-point sources of residual loadings onto surface waters in the Basin area.

Throughout most of the eight Basin States, there have been few State level management programs to regulate non-point source aspects of transportation systems. Generally, these activities are controlled by regulations covering pesticides and herbicides, sedimentation, and solid waste disposal. There are currently few programs among these States to control surface runoffs such as salts, sand and oil from road systems.

Environmental impact statements (EIS) are generally required prior to construction of new transport facilities. The EIS procedures can be used by the States to control pollution from these sources.

In Ontario erosion and sediments as affected by highway and related construction is considered during planning and design phases of project development. Erosion control techniques are incorporated into construction contracts

where sensitive aquatic systems may be adversely affected and project construction staff is trained in required remedial measures.

Shoreline and River Bank Erosion

Shoreline and river bank erosion is being studied by both countries to determine sediment loads and bank recession mechanisms to aid control methodology.

Similar studies are being conducted on critical erosion zones in the Great Lakes. Canada, Ontario and Michigan have prepared inventories of erodable shoreline and damage caused by high water levels with a view to making management recommendations. Similar studies are in progress in the other States. Michigan program for protection of property owners in high risk areas is now being implemented. It is noted that man's ability to control natural erosion is extremely limited.

Most states and local municipalities in the Great Lakes Basin have regulations controlling set-back from shorelines. The U.S. Federal Coastal Zone Management Act of 1972 (PL92-583) should provide overall leadership for coastal zone and shoreline management. Implementation is carried out by the local municipalities while the planning and coordination are done by the States.

Municipalities in Ontario may employ criteria for setback from lake shores under planning and zoning bylaw requirements where developments may be proposed on hazardous lands.

Shoreline Landfilling

Shoreline landfill of dredged or fill material may be

authorized by the U.S. Army Corps of Engineers subject to site selection guidelines of the EPA which may veto any site on certain environmental grounds. Land use related pollution control programs will be developed on the U. S. side by states in accordance with the requirements of Section 208 of the Federal Water Pollution Control Act. The Board intends to coordinate this effort to monitor compliance with IJC requirements.

In Canada landfilling which may affect water quality and aquatic habitat is controlled under the Public Lands Act and the Environmental Protection Act. Applicable sections of the Public Lands Act deal variously with land use, zoning control of land improvements, conditions of tenure and control of waste deposits and garbage. Related policies of the Ministry of Natural Resources are concerned with dredging and spoil disposal, use of Crown Lands for sewage disposal, disposition of water lots and construction of causeways and bridges.

Dredging and construction which may affect navigation and use of Ontario Crown Lands and resources are controlled under the Navigable Waters Protection Act, the Public Lands Act, the Beach Protection Act and the Environmental Protection Act.

Forestry

Management of forestry operations to prevent adverse effects on water quality is controlled by both the federal and state governments. State sediment control and pesticide regulations apply to land-use activities in private forests and in some cases such as Michigan to federal forests. Section 208, PL 92-500 also provided a mechanism for identification and control of non-point sources of pollution from silvicultural activities.

In Ontario most forest operations are carried out under crown licenses and regulated by the province. Guidelines are employed which operators use in preparation of plans of proposed activities in the Province.

Mining

Surface mining in the United States is extensively regulated with procedures requiring land reclamation, backfilling, grading, planting and prevention of groundwater degradation. There are, however, obvious problems with mining wastes as demonstrated by the case of Reserve Mining in Minnesota. Regulations are also in place for the control of acid mine drainage for underground operations. Section 208 of PL 92-500 also provides an opportunity for the control of mine related sources of pollution.

Mining operations in Ontario are provided with individual requirements utilizing water and waste recirculation where possible.

Recreation

There has been significant increase of recreational land use activities in the past several decades. In all jurisdictions in the Great Lakes Basin, general water quality regulations and standards are applied to control pollution from such activities. Existing laws on sediment control, animal wastes and application of pesticides and herbicides are effective to a limited extent. The main difficulty lies in establishing control procedures to insure observance of such regulations by individual users.

Surface Disposal of Liquid and Solid Wastes

Among the health and water pollution control agencies

in the United States, only a few have specific statutes or regulations relating to land disposal of liquid and solid wastes. However, most of them have some informal guidelines, while others operate on a case-by-case basis. In some states, regulations related to the design and installation of individual family dwelling sewage systems have been developed.

Ontario certifies waste disposal sites and systems for waste management. The Province regulates hauling and disposal of waste material and sewage sludge, and guidelines are available for waste utilization. The Province also administers regulation of private waste disposal systems. Waste management sites are surveyed and selection of operation is regulated. The Province recently embarked on a fifteen-year resource recovery program to reduce the use of landfills, maximize recovery and recycling of reusable material and provide an energy source.

Subsurface Disposal of Liquid Wastes

Most States prohibit or do not encourage deep well disposal due to limited knowledge concerning the effects of subsurface waste injections on various geological formations and their consequences on ground water and aquifers. Subsurface injections will be viewed as a method of waste storage rather than a form of final disposal. Problems have been encountered with improperly capped abandoned oil and gas wells in Michigan and Ohio. Pressure from deep well injection has caused some of these wells to overflow. The location of many of these wells is unknown and preventive control of oil and brine migration can go unchecked until serious problems become apparent. The Safe Drinking Water Act, PL 93-523, establishes requirements for regulations controlling deep well disposal of wastes.

Ontario's policy is to reduce to the absolute minimum the use of deep wells for liquid waste disposal. Preference is given to methods of reclamation, reuse and incineration and only where no better method of disposal exists are approved liquid wastes accepted for disposal into the Cambrian formation.

SHIPPING

The Parties agreed to develop measures to control pollution from shipping activities which include the adoption of compatible regulations for the control of vessel wastes (Annex 4) and the consideration of vessel design, construction, operation, navigational aids, etc, (Annex 3 and 5) as they could reduce or control pollution from shipping activities.

Vessel Waste Regulations

The existing U.S. vessel waste regulations provide for no discharge with a time limit of 2 years for new and 5 years for existing vessels to conform, and a provision that approved treatment devices installed in the interim may continue to be operated for the life of the device. The U.S. law also provides administrative procedures for prohibiting discharge in certain waters.

State regulations concerning waste discharges, which are based on a no discharge requirement in the Great Lakes, are pre-empted by the U.S. federal regulation. The states of Michigan, Minnesota and Wisconsin have recently applied for a discharge prohibition under section 312 (f) (4) of P.L. 92-500.

Proposed Canadian federal regulations provide for either no discharge or adequate flow-through systems. New

and existing vessels, excluding pleasure craft, must be equipped within 2 and 5 years respectively with approved devices.

The Ontario regulation prohibits the overboard discharge of any form of sewage from pleasure boats. The province would accept adequate flow-through systems on large vessels as an interim measure, but considers a requirement of total containment desirable as soon as possible.

Vessel Design, Construction and Operation and Pollution From Shipping

Annexes 3 and 5 of the Agreement relate to vessel design, construction and operation and pollution from shipping sources. As pollution from point sources is abated, these navigation-related pollution sources increase in importance. The Board is continuing to inquire about the progress being made by the government agencies concerned with studies and analyses of these problems and has been disappointed by the apparent lack of progress in these important assignments.

DREDGING

There has been a marked increase in construction activities along the coastlines of the Great Lakes. These have included harbor facilities, channels, marinas, industrial installations, utilities and sub-division and landfill improvements with various effects upon the ecosystem of the lakes.

The U. S. EPA, in cooperation with the Corps of Engineers, is developing guidelines which are being applied for disposal of dredged materials in open lake and inland navigable waters. In Canada, dredging activities are being controlled

by cooperative arrangements between the federal and provincial governments. Restrictions are placed on every project by both governments.

The U.S. Corps of Engineers is proceeding with dredging projects in the Great Lakes, particularly in Lake Erie and Lake Ontario in spite of objections by U.S. EPA that polluted dredged spoil is being dumped into the open waters of the Great Lakes. It is the contention of the Corps of Engineers that as long as the construction is diked disposal areas is on schedule but not yet available for spoil disposal, these projects can proceed with open lake dumping.

The International Working Group on Pollution from Dredging Activities established under the Agreement has completed its review of existing dredging practices, programs, laws and regulations with the objective of developing compatible criteria for the characterization of polluted dredged spoil and recommendations for compatible programs governing the disposal of polluted dredged spoil in open water. Their report will be presented to the governments in July 1975.

ONSHORE AND OFFSHORE FACILITIES

Programs for the control of oil from onshore and offshore facilities in Canada are being implemented through the federal Petroleum Refinery Effluent Regulations and Guidelines and provincial requirements under the Ontario Water Resources and Environmental Protection Acts as well as the Ontario Gasoline Handling Act. On the U.S. side discharges of oil are being effectively handled by the U.S. Oil Pollution Prevention Regulations.

Specific programs for the control of hazardous polluting substance from onshore and offshore facilities are still in

early stages of development in both Canada and the U.S. These programs will be intensified as soon as the Annex on Hazardous Polluting Substances has been developed further. The Canadian program will likely involve the development of guidelines and codes of good practice for prevention of spills of hazardous materials from onshore and offshore facilities. The U.S. is considering the development of regulations similar to the Oil Pollution Prevention Regulations under Section 311 of PL92-500. It is expected that both programs will be well underway by the latter part of 1975.

Gas produced in Ontario from wells operating in Lake Erie contributes about 70 percent of the production in the Province. By 1974, some 830 wells had been drilled in the lake of which 300 were active producers in that year.

Drilling activities are confined to the part of the lake east of Point Pelee. Rigid controls are maintained by the Province over drilling and production operations.

JOINT CONTINGENCY PLAN

The revised Joint U.S./Canadian Oil and Hazardous Materials Contingency Plan for the Great Lakes Region became effective April 1, 1974. The Plan establishes clear lines of authority and action, preventing delayed response due to jurisdictional disputes. The United States Joint Response Center is located at the Rescue Co-ordination Center, Ninth Coast Guard District Office, Cleveland, Ohio, and the Canadian Joint Response Center is located at the Central Region Marine Services, Ministry of Transport, Toronto, Ontario.

Experience gained in implementing the Plan during several spills in 1974 indicated a need for some improve-

ments in communication which have been undertaken.

A pilot study, on the St. Clair River, on techniques for containing and recovering oil from fast moving waters was attempted in 1974, and will be continued in 1975.

A Computer Support System for Environmental Emergency Management has been developed by Environment Canada which provides field personnel with information required, such as equipment location and characteristics of hazardous materials to respond to spills. Initially the system only contained data on Canadian equipment, however, Michigan is now using the system and Wisconsin is considering participating. Ontario and all the Great Lake states, with the exception of Pennsylvania, have developed contingency plans. These vary from a notification directory to comprehensive plans including instructions and equipment location.

HAZARDOUS POLLUTING SUBSTANCES

The Canadian legislation, the Environmental Contaminants Act, to control or prevent the manufacture, sale and distribution of products hazardous to human health and the environment has undergone second reading in Parliament and the final reading is expected in the near future.

The consultant's study dealing with Hazardous Polluting Substances was completed in April, 1974, and subsequently reviewed by federal and provincial agencies. The report is considered to present a good initial listing of hazardous polluting substances encountered on the Canadian side of the Great Lakes Basin.

On the U.S. side the Environmental Protection Agency is developing regulations for the identification of hazardous

substances and harmful quantities thereof for promulgation under Section 311 of PL92-500. A preliminary list of hazardous material was published in August 1974 in the advance notice of proposed rulemaking.

During the past year, the Canadian and U.S. groups working on the development of the Annex on Hazardous materials met to discuss status of the Annex and related programs and other measures for controlling such materials from vessels, onshore/offshore facilities and in the event of contingencies. Both sides are well along in the development of the Annex and it is expected that the Annex will be completed by December 31, 1975. The one issue which may be difficult to resolve by that time is the definition of "harmful quantities."

EFFECTIVENESS OF THE AGREEMENT AND FUTURE STRATEGIES

According to the 1972 U.S.-Canada Agreement, programs directed towards the achievement of water quality objectives would be completed or in the process of implementation by December 31, 1975.

Surveillance and Remedial programs are in progress which address themselves to the requirements outlined in the Agreement. More important, however, is a pressing need for realistic assessment of the effectiveness of these programs to determine whether or not adjustments should be made in the programs. A re-assessment of the Agreement is required by April 1977, and towards that end effectiveness should be assessed in terms of water quality improvements.

The determination of changes in water quality in these large bodies of water over a short period of time is difficult if not impossible. Nearshore areas respond to remedial measures more rapidly and the effectiveness of programs can be monitored through improvement in water quality in those areas.

Within the Great Lakes Basin, there are geographical locations where the water quality objectives are not being met. These areas have been identified as "problem areas" in Figure 3 and Tables 15 and 16. In most cases, the problem areas are situated at either the mouths of tributaries or in the vicinity of populated urban centres. The cause of water quality degradation can often be attributed to some significant waste dischargers. Details of the reasons for non-compliance with water quality objectives and remedial programs in place or proposed are included in Appendix C.

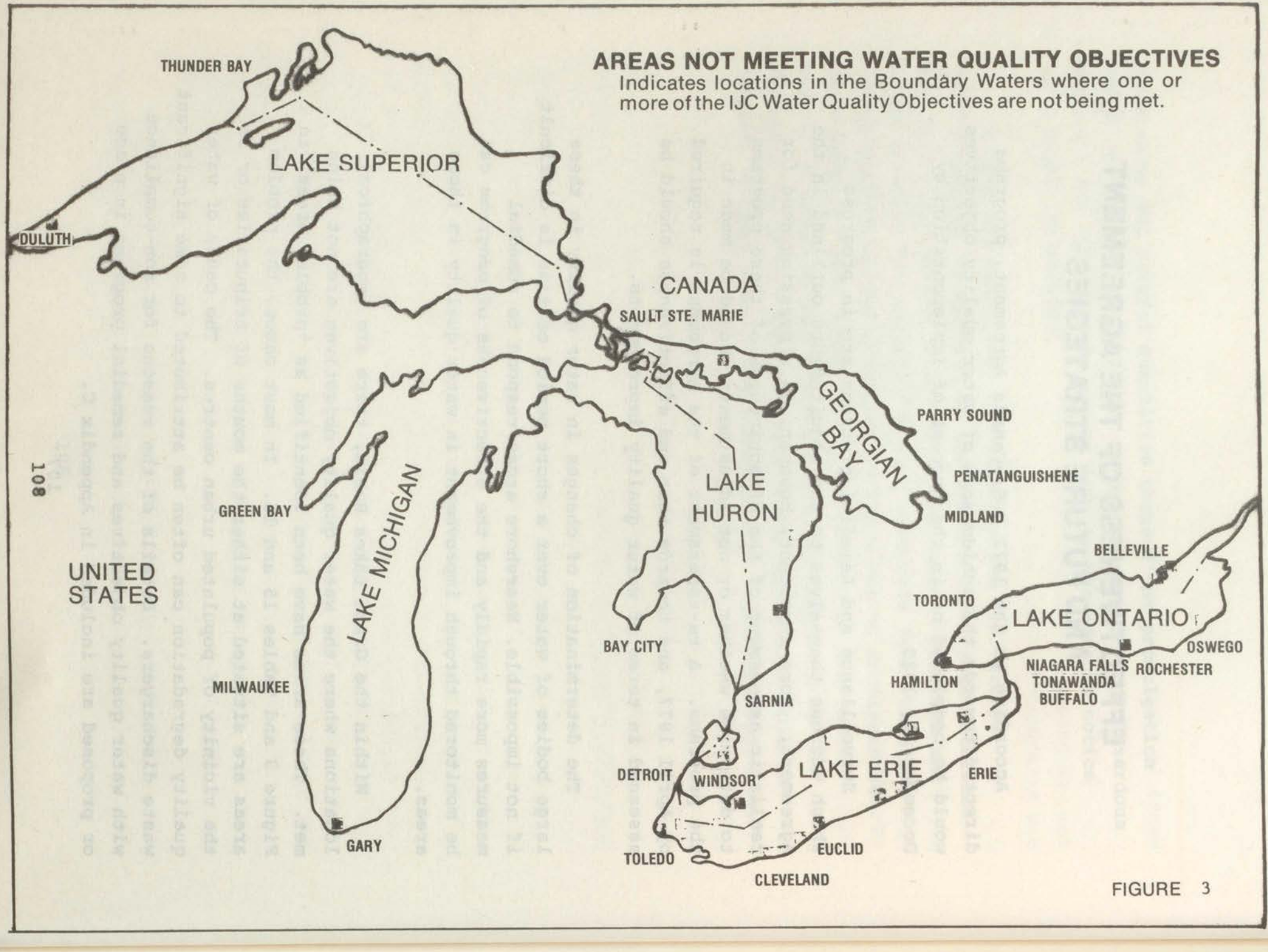

AREAS NOT MEETING WATER QUALITY OBJECTIVES
Indicates locations in the Boundary Waters where one or more of the IJC Water Quality Objectives are not being met.
THUNDER BAY
LAKE SUPERIOR
DULUTH
CANADA
SAULT STE. MARIE
GEORGIAN BAY
PARRY SOUND
PENATANGUISHENE
MIDLAND
LAKE HURON
GREEN BAY
LAKE MICHIGAN
UNITED STATES
BELLEVILLE
TORONTO
LAKE ONTARIO
OSWEGO
NIAGARA FALLS
TONAWANDA
BUFFALO
ROCHESTER
HAMILTON
BAY CITY
SARNIA
MILWAUKEE
DETROIT
WINDSOR
LAKE ERIE
ERIE
GARY
TOLEDO
EUCLID
CLEVELAND
108

FIGURE 3

TABLE 15

AREAS IN THE UPPER LAKES NOT MEETING WATER QUALITY OBJECTIVES

Lake Superior Basin	Lake Michigan Basin	Lake Huron Basin
Thunder Bay Harbour	Green Bay Area	Saginaw Bay
Marathon-Peninsular Harbour	Milwaukee Harbor	St. Mary's River
Jackfish Bay	Indiana Harbor Ship channel and inner harbor basin	Penetang Bay
Nipigon Bay		Midland Bay
Silver Bay		North Channel (near Spanish River)
St. Louis River		Serpent River
Duluth Harbor, Minn.		McCurry Lake Outlet
Duluth Harbor, Wis.		Maitland River
Area from Duluth to Sand Point		Douglas Point
Chequamegan Bay		
Area from Chequamegan Point to Montreal River.		

NOTE: Except for connecting channels, problem areas identified with rivers refer to areas in the boundary waters at the mouth of the river.

TABLE 16

AREAS IN THE LOWER LAKES NOT MEETING WATER QUALITY OBJECTIVES

Lake Erie Basin	Lake Ontario Basin
Cleveland Area	Niagara River
Toledo Area	Twelve Mile Creek
Sandusky River	Hamilton Harbour
Huron River	Toronto Harbour
Vermilion River	Oshawa Creek
Rocky River	Etobicoke Humber River
Ashtabula River	Duffin Creek
Conneaut Creek	Don River
Chagrin River	Highland Creek
Portage River	Moira River
Black River	Port Hope Harbour
Grand River, Ontario	Bay of Quinte
Detroit River	Buffalo River
St. Clair River	Tonawanda Creek
Thames River	Niagara Beach
Sydenham River	Olcott Harbor
Western Lake Erie	Rochester Harbor Area
Pelee Island	Oswego Harbor Area
Wheatley Harbour	Black River
Big Otter Creek	St. Lawrence River
Big Creek and Lynn River	
Kettle Creek	
Grand River, Ohio	
Long Point Bay	
Fredonia Area	
Westfield Area	

NOTE: Except for connecting channels, problem areas identified with rivers refer to areas in the boundary waters at the mouth of the river.

One method for gauging effectiveness is to closely monitor the problem areas which have been identified. Surveillance efforts must be reviewed to ensure that adequate data are being acquired for the nearshore problem areas and connecting channels. In addition to water quality data, information collected for these problem areas must include reliable measurements of municipal and industrial effluent loadings, combined and stormwater discharges and other non-point source inputs.

Improvements in water quality on a lakewide basis will be the final measure of the success of current remedial strategies identified in the Agreement. Determination of the effectiveness of remedial programs in improving lake-wide water quality is extremely difficult due to response times of many years, and long term surveillance of lake water quality are necessary to discern trends. This is true of all conservative water quality characteristics, especially phosphorus and persistent pollutants. Better modelling efforts are expected to improve the predictability of the long-term response of the lakes to remedial programs.

Reductions of specific waste loads provide another indication of progress. Loadings should be summed over each individual lake basin, and the changes recorded. This measure of program effectiveness requires a high integrity of waste loading data which, to date, has been difficult to obtain.

The number of National Pollutant Discharge Elimination System (NPDES) permits issued to waste dischargers in the U.S. or similar programs in Canada are measures of the present effectiveness of these programs. Numbers of enforcement actions, and civil or criminal court cases, are a measure of the effectiveness of the enforcement program to respond to violations of permit requirements.

The availability of adequate funding for, and the completion of construction of sewage treatment facilities are important measures of progress in providing effective programs for the control of municipal pollution.

UNITED STATES

Some weaknesses identified in current U.S. programs include delays associated with the construction grant program, impoundment of funds and a need for additional staff for surveillance and compliance monitoring.

The correction of certain legislative, regulatory and management problems could assist in furthering program implementation to meet the objectives of the Agreement. These should be corrected if early progress is to be made. The complexity of the U.S. Federal Public Law 92-500 and regulations governing the construction grants program (specifically the regulations covering the planning, designing and construction of sewage treatment plants) has been cited as the most significant reason for delays in meeting some of the short term objectives of the Agreement.

The development of projects that are otherwise ready for construction is often delayed by the requirements in the grants section (Title II) of the Federal Water Pollution Control Act of 1972 (such as infiltration and inflow, land disposal alternatives and other requirements intended to assure cost effectiveness of the project). The regulations and guidelines which arise out of the Act have been changed and expanded and these have imposed a growing number of retroactive requirements on urgently needed pollution abatement projects.

In order to remedy some of these problems, adjustments

have been made in manpower utilization and proposals have been advanced whereby state agencies may undertake certain aspects of the construction grants program. Legislation has been proposed which would give state agencies complete responsibility for managing the construction grants program.

Establishment of concrete program goals, review deadlines, delegation of responsibilities from EPA to the States, and more flexible funding arrangements would expedite the completion of projects.

The recent United States Supreme Court decision which resulted in the release of $5 billion in impounded funds has drawn attention to the fact that FY 76 will mark the end of the $18 billion authorized by Congress in 1972. These funds represent the largest amount of financial support of municipal sewage treatment projects ever dedicated by a nation in the history of water pollution control. There is currently no indication of the amount or percentage of further federal funding that will be available for treatment plant construction. Federal and State governments should place high priority on the provision of continued funding to satisfy future pollution control needs.

CANADA

In Canada, monies obligated by Ontario, Canada and the municipalities for sewage works construction have generally been adequate to establish sewage collection and treatment programs. At present, facilities must be maintained and adjusted to keep pace with changes in population distribution.

The highest priority should be given by the Federal and Provincial Governments to the continued provision of adequate funding to sustain the pace of sewage works construction and

thereby maintain compliance with the water quality objectives. This will require funding for completion of the remaining backlog of sewage works construction, and continued improvement and upgrading of facilities in light of continuing growth pressures. The impact of stormwaters on combined sewer systems and treatment plants and the direct flow of such waters into the lakes has yet to be established. Literature sources indicate that this impact is of considerable significance.

Compliance and Enforcement

Compliance monitoring and enforcement must be carried out effectively if remedial programs are to be effective in the achievement of both national legislation objectives and Agreement objectives. Lack of, or improperly ordered priorities in monitoring, inspections, and legal actions may result in a massive program effort with little real accomplishment. Primary efforts should be directed at those significant dischargers that have been historically neglectful and recalcitrant on pollution abatement measures.

During 1974, the emphasis of the U.S. NPDES program was on the issuance of permits. Emphasis is now shifting to compliance monitoring and enforcement. In some cases, permit limitations have been challenged by industrial dischargers and adjudicatory hearings are pending. In such instances this may lead to further delays in specific remedial measures and attainment of BPT (Best Practicable Treatment) and/or water quality standards.

Many municipal NPDES permits where construction needs are involved are "status quo" permits terminating by July, 1977 because the uncertainty of the availability of federal funds precludes the establishment of construction schedules and permits which require less than BPT after July 1977 cannot be issued.

The Board has determined that State level manpower needs for compliance monitoring are substantially higher than available resources.

Future Strategies

The primary emphasis of the Agreement is of a restorative nature. It was developed in the interest of furthering efforts to clean up existing pollution problems in the Great Lakes. With resolution, in the near future, of immediate program deficiencies, governments should now consider future long term strategies.

Planning. Future population growth and economic development in the Great Lakes Basin is certain to have impact on water quality. Furthermore, population growth outside the basin will also affect the use and quality of Great Lakes waters. This is exemplified by the anticipated increase within the basin of electrical generating capacity to satisfy power needs outside of the basin. Measures of abating pollution that may be considered adequate to meet objectives of the Agreement in 1975, may not be adequate in the future. The Board wishes to draw attention to this fact and urge a common assessment of the adequacy of remedial programs to meet the demands of future growth in the Great Lakes System. This will involve an evaluation of the effectiveness of various planning efforts underway by Federal, State and Provincial agencies and others as they relate to the achievement of the water quality objectives for the Great Lakes. Future activities must also address the land use problems being identified in the Study of Pollution from Land Use Activities.

Since water quality management plans have a significant impact on land use and conversely land use affects water quality, future strategies will have to address land use

questions. The Board urges that adequate funding for water quality management planning be provided within governments. These efforts should be designed to encourage meaningful participation by local interests in the planning process.

UNITED STATES

The U.S. planning requirements specified by PL 92-500, the Water Resources Planning Act (PL 89-80) and the Coastal Zone Management Act (PL92-583) are seen as the major instruments to ensuring the future effectiveness of pollution abatement measures and water related land resources management.

Generally, the planning program in PL 92-500 operates at three interrelated levels: basin planning, areawide planning and facilities planning.

The development of basin plans includes tributary modelling, and the allocation of allowable waste loads in stream segments where treatment better than Best Practicable Technology (BPT) is required.

Areawide or metropolitan planning promotes the development of appropriate population, economic and land use bases and projections on which regional water quality management plans can be developed. State agencies designate areas which have major water quality problems and a single representative organization capable of developing effective areawide waste treatment management plans for the area. Such designations are subject to U.S. EPA approval. In order to assist in the preparation of areawide plans, planning grants were established under Section 208 of PL 92-500. These programs include intensive analysis of urban-industrial areas and require the development of point and non-point source controls.

Facility plans for construction projects are developed to adequately address the requirements of PL 92-500. Elements emphasized include alternatives, cost effectivenesss, and environmental evaluation of proposed facilities. When necessary, Environmental Impact Statements (EIS) are prepared by the U.S. EPA.

In addition to the above, Interagency planning is ongoing to insure that water quality, water supply and other environmental programs are incorporated into planning documents and project reports. U.S. EPA and state agencies are involved in cooperative interagency planning efforts on the Great Lakes through the Great Lakes Basin Commission. U.S. EPA also participates in the activities of the Federal Regional Council Task Forces.

The Water Resources Planning Act (PL 89-80) provides for the optimum development of natural resources through coordinated planning of water and related land resources. It established the Water Resources Council which periodically makes assessments of the adequacy of water supplies necessary to meet water requirements. It maintains a continuing study of the relation of regional or river basin plans and programs to the requirements of larger regions of the Nation and of the adequacy of administrative and statutory means for the coordination of water and related land resources policies and programs of several Federal agencies. The Council reviews and makes recommendations upon plans developed by river basin commissions which are also established under the Act.

The Great Lakes Basin Commission (GLBC) serves as the principal agency for coordination of Federal, State, interstate, local and nongovernmental plans for the development of water and related land resources in the U.S. portion of the Great Lakes Basin. The main charge of GLBC is the preparation and

maintenance in a current status of a comprehensive coordinated joint plan for conservation, development and utilization of those resources in the Great Lakes Basin. This plan will provide specific recommendations for resource development. An initial step in the formulation of this plan has been the development of the Great Lakes Basin Framework Study. It examines future needs, problems and alternative programs necessary to meet the needs and solve the problems according to the objectives of the people in the Great Lakes Basin.

The Coastal Zone Management Act is one of the most important developments on the national level dealing with coastal and shoreline resources in the last decade. The Act, if properly administered and with the co-operation of the States, has the potential for bringing about a research improved management scheme for the U.S. coastal zones including the Great Lakes.

The Act's purpose, as stated in Section 303 Declaration of Policy, declares that it is now national policy to preserve, protect, develop and where possible to improve the coastal resources. It will also help the states manage their coastal responsibilities wisely through the development of appropriate programs. The Act further emphasizes that it is national policy to encourage co-operation among state and regional agencies including the creation of agreements, procedures and joint action particularly regarding environmental problems.

CANADA

Ontario is beginning to implement its Design for Development Program - a comprehensive planning framework within which Provincial strategies and guides for use of land and related resources can be refined by regional and local governments. Options considered bv the Province in response to needs of future populations should be compatible with the water quality objectives of the Agreement.

Recent amendments to the National Housing Act would empower Central Mortgage and Housing Corporation in making loans and grants for sewage works construction to enter into an agreement with each Province which would set out the general objectives of the Province for urban growth, water management and environmental control. Such an agreement would embrace funding for future sewage works requirements in the Great Lakes Basin.

Facility Design and Operation. In order to maximize cost-effectiveness, design periods for sewage treatment plants and major interceptors should be selected to correct immediate problems and provide limited capacity for future growth. Reduced design periods make it possible to meet more of the existing needs with available capital funding and may make many marginal projects more financially feasible. In addition they would allow more flexibility in future project planning and development permitting earlier adoption of new technology, and leading to more orderly growth in developing communities. Control of urban sprawl can also be achieved through proper design and planning of interceptors and trunk sewers.

Provision for growth by the improvement of existing facilities should be guided by the systematic analysis and forecast of needed capacity of treatment. This problem has been variously approached by the States and the Province of Ontario. In Pennsylvania, project analysis conducted by the State provides for cycles of planning and periods of design for new construction. In Ontario project capacity vis-a-vis commitments for household sewage connections are reviewed annually by the Province. The Ministry of Environment strives to advise municipalities of the limitations of existing facilities three years in advance of the need for additional sewage treatment capacity.

There is a need to establish the adequacy of funding and manpower for the construction and operation of treatment facilities as well as the conduct of the other necessary remedial programs at all levels of government.

All of the states have operator certification programs but in some there is a general lack of qualified personnel to manage training programs. In most instances the number of available certified operators is adequate, but many smaller municipalities are reluctant or unable to pay competitive salaries.

Other Considerations. Approaches may be required to achieve reduction of waste and continued compliance with the water quality objectives as growth pressures continue. These may include modified water and sewage rate structures to discourage greater water consumption or production of waste. Further, in addition to regulatory actions, the need may arise for further incentives to achieve compliance with pollution control requirements especially as these may become progressively more stringent. A selective system of effluent charges might provide encouragement to delinquent waste dischargers to comply with pollution abatement schedules.

Currently, the recessionary state of the economy has had severe effects upon the construction industry. It is estimated that over 16 percent of construction related work force is unemployed. Barring any unexpected sudden economic recovery, there is no immediate shortage of construction manpower resources. Recent estimates show that each $1 billion spent for sewage treatment facility grants could result in approximately 40,000 jobs. More than 20,000 would be in the construction industry. Effective operation of municipal sewage treatment facilities requires sufficient financial resources for chemicals, salaries of staff,

maintenance and repair of facilities, etc.. Federal funding is not available for operation and maintenance of treatment facilities. Adequacy of financial resources varies significantly among municipalities. Ordinarily, the larger cities are capable of providing sufficient operating funds and paying salaries of trained operators and staff. Problems are encountered however with maintenance and repair costs.

Programs administered by all Governments should be examined to identify means of improving their effectiveness through better regulations and re-distribution of manpower resources. As state agencies assume more of the programs and responsibilities of national legislation, their funding and manpower needs will become more significant.

INSTITUTIONAL ACTIVITIES

The Water Quality Agreement required that the Commission establish a Great Lakes Water Quality Board to assist it in the exercise of the powers and responsibilities assigned to it under the Agreement. It was also required that the Board have an equal number of members from Canada and the United States including representation from the Parties and from each of the State and Provincial Governments.

The Water Quality Board was directed by the Commission to be its principal advisor in the exercise of all the functions, powers and responsibilities, other than research assigned to the Commission under the Agreement.

The Commission directed the Board to establish such committees and work groups as it may require to discharge its responsibilities effectively, to enlist the co-operation of Federal, State or Provincial departments or agencies in Canada and the United States and, to keep the Commission informed on the duties and composition of the committees and work groups.

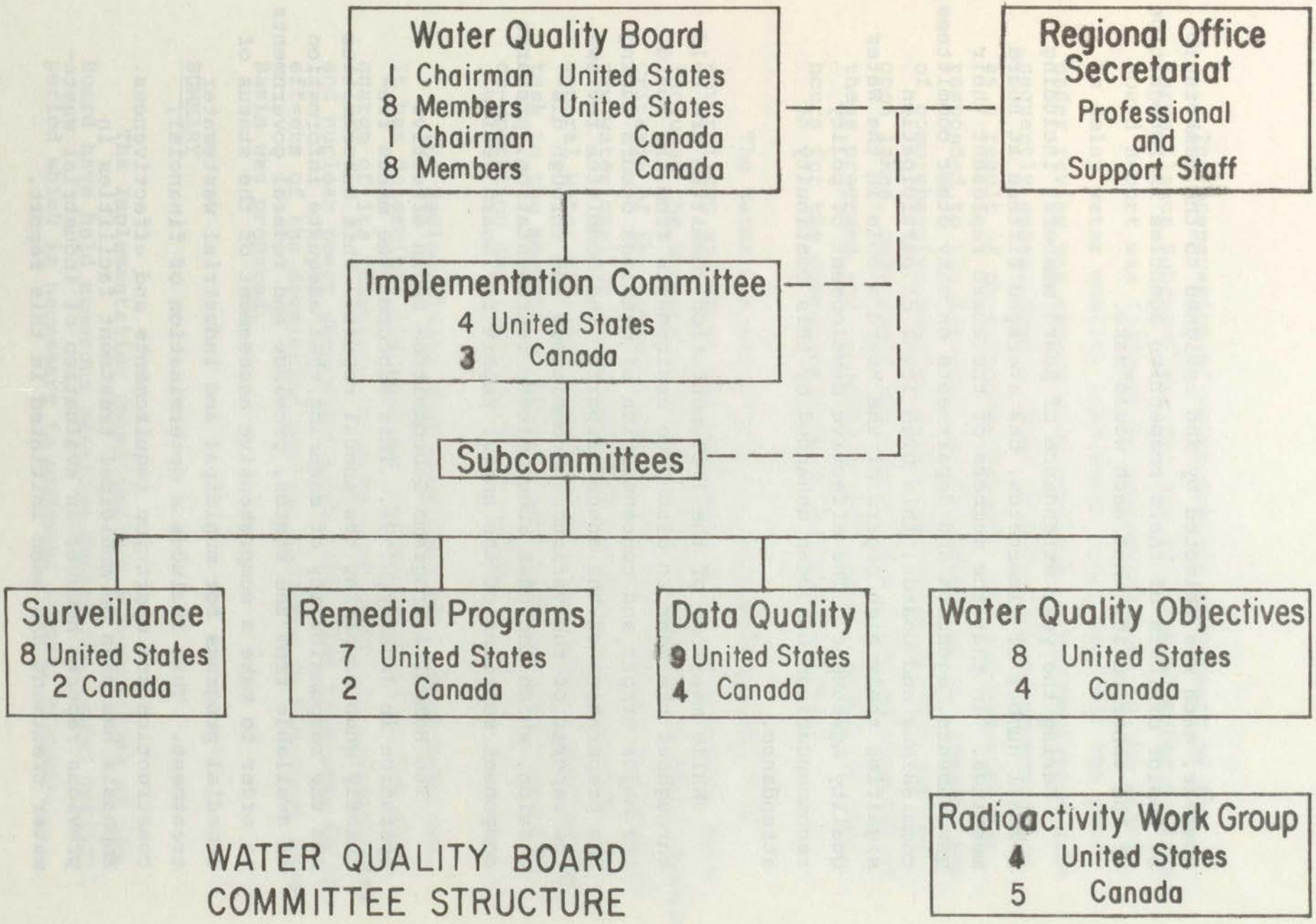
The Board, its committee and subcommittees assisted by the Regional Office has prepared a number of semi-annual and annual reports to the Commission which have presented the status of the implementation of major facets of the Agreement. This, the Third Annual Report, has been structured in greater depth than previous reports as a result of the subcommittees

having matured to a sharper sense of direction and increased awareness of their objectives. The increased professional and technical support from the Regional Office materially assisted the committee and subcommittees.

In June 1974, the Board, Regional Office and Commission agreed on the role of the Regional Office as documented in the Preamble to the Working Document - Functions and Responsibilities of the Regional Office. Included in that role is the requirement to provide technical and administrative support for the Board and in providing that support to be subject to its direction. Many support activities have not progressed due to lack of scientific staff which, although approved as to numbers, takes several months to process through classification and grade level procedures to recruitment and reporting for duty.

The committee structure of the Board, Figure 4, was developed and approved by the Board through a series of meetings to its ninth meeting, November 1973. The terms of reference and membership of the committee and subcommittees were subsequently formally approved by the Commission. The problems of data quality became significant as the Reference Groups, particularly the Upper Lakes Reference Group, progressed in their studies. The Board in recognition of the need for a continuing committee developed and approved the structure of the Data Quality Subcommittee at its fifteenth meeting in December 1974.

The Implementation Committee and the subcommittees have made substantial progress in meeting the objectives of the terms of reference assigned to each. Each member of the committee and subcommittees, including chairmen, have prime responsibilities to their federal, state or provincial agencies.



WATER QUALITY BOARD
COMMITTEE STRUCTURE

FIGURE 4

However, each was selected by and assigned to the membership by senior officers of their respective agencies in recognition of the contribution that each would make.

During the year attendance of Board members, including a small number of alternates, has averaged fifteen at Board meetings. In that the members of the Board represent their governments, agencies and departments on many other committees, commissions and boards, this high level of participation signifies their high regard of the Board's role in the Water Quality Agreement. The effective development of policy recommendations has been enhanced by this continuity of attendance.

While meetings of the Implementation Committee are held throughout the year to discharge assignments from the Board its major effort and concentration of meetings occurs during the preparation of the annual report. The committee reviews the reports of the various subcommittees and through discussion, which includes subcommittee representation, prepares component sections of the annual report for Board review.

The Remedial Programs Subcommittee began effective operation in January, 1974. This subcommittee meets frequently when preparing the annual report. This subcommittee has the responsibility of ensuring that adequate information is available from the states, province and federal governments in order to make a comprehensive assessment of the status of remedial programs for municipal and industrial wastewater treatment. This includes a determination of financial, construction and operation requirements and effectiveness. Emphasis has been on municipal treatment facilities in previous reports however an evaluation of industrial wastewater treatment has been initiated in this report.

The preparation of water quality assessment by the Surveillance Subcommittee for the 1973 Annual Water Quality Board Report was followed by recommendations to the Board to delay water quality assessment until data for the year under review was essentially complete. The Commission subsequently established a later date for report presentation as a result of this recommendation. The subcommittee has responded to the directive of the Board for the preparation of comprehensive monitoring and surveillance programs for open lakes, near shore and other areas. The development of these programs has required a considerable number of man hours for the committee members and agency staff.

The Water Quality Objectives Subcommittee has held several two and three day meetings which, on occasion, have included the members of the Standing Committee on Water Quality Criteria of the Research Advisory Board. The development of new water quality objectives and review of the specific and general water quality objectives has presented a challenging task to the members of this subcommittee and requires full co-operation and input from its members.

The Radioactivity Work Group has held three meetings. It has determined its role and has been active in the discharge of its function. A background report on radioactivity and nuclear power generation with particular reference to the effects of the developing nuclear industry in the Great Lakes Basin was prepared.

SUMMARY

The Implementation Committee and subcommittees of the Board have held numerous meetings during the annual cyclical period which is necessary to prepare, submit, approve,

implement and assess the programs and procedures developed for the evaluation of the annual status of the implementation of the Agreement for the Annual Report.

The membership of the committees is comprised of a large number of representatives from both federal governments and states and provinces. It is essential that the preponderance of representatives be from the second level of senior governments in that matters pertaining to the environment including water quality fall largely with these jurisdictions. Most of the data required to evaluate the status of the Agreement has been gathered by the states/provinces results in the exercise of their jurisdictional responsibilities.

Many states have a relatively minor portion of their land mass and population in the Great Lakes Basin while others have extensive portions in the Basin. In many instances the requirements for gathering, assessing and reporting constitute considerable additional work loads, therefore man years and expense, over that considered normal to their internal and external juridictional responsibilities.

The representatives of the states/provinces on the committees, etc. attended meetings which required approximately 400 man days for preparation, travel and attendance while the federal representatives required over 200 man days. The time spent at meetings represents only a small portion of the man hours expended by the states/provinces in providing the information and data as agreed to by the governments under the terms of the "Procedures for the Submission and Exchange of Information".

Adherence to the procedures necessitates a significant assignment of manpower and funds for field, laboratory and analytical work.

Representatives of the states/provincial governments have emphasized that the assignment of staff and material to Great Lakes Water Quality Agreement work will be constrained due to competition for available budget funds.

The Regional Office cannot assume the burdens of data gathering, etc. which is the jurisdictional responsibility of the several levels of government. Neither should it increase its staff to assume the duties of the committees. It should however, be prepared to provide more extensive staff support to the committees when it reaches its staff complement. The Commission should obtain funds and, through the Regional Office acting on behalf of the Water Quality Board, should be prepared to allocate such funds to the jurisdictions for the sole purpose of ensuring that information supplies is adequate to assess the progress of all governments in complying with the Great Lakes Water Quality Agreement.

WATER QUALITY OBJECTIVES

Development and adoption of common water quality objectives for the Great Lakes is recognized as one of the primary program elements of the Canada-United States Great Lakes Water Quality Agreement of 1972. Common objectives will provide direction for all water quality surveillance programs, will be of critical importance in evaluating the success of remedial programs, and should provide protection for designated uses.

The task of developing proposed common water quality objectives for consideration by the International Joint Commission (IJC) was assigned to the Water Quality Board's Water Quality Objectives Subcommittee. This Subcommittee was charged with assessing the adequacy of, and refining where necessary, the General and Specific Objectives in the Agreement, as well as recommending specific objectives for water quality parameters not included in the Agreement. The Subcommittee has been effectively aided in its task by the IJC Research Advisory Board's Standing Committee on Scientific Basis for Water Quality Criteria.

THE DEVELOPMENT PROCESS FOR ESTABLISHING WATER QUALITY OBJECTIVES

As considered by the Subcommittee, water quality objectives describe, in part, a minimum quality of water which will not only provide for but protect any designated use.

However, establishment of water quality objectives alone may not ensure against future losses of the beneficial uses which the Parties desire to secure and protect. The objectives should be implemented in concert with limitations on the extent of areas of non-compliance such as mixing zones or zones of influence and localized areas as designated by the regulatory agencies.

In its present form the Agreement restricts mixing zones to the "vicinity" of outfalls, urges keeping localized areas to a "minimum" and establishes a non-degradation philosophy of taking "reasonable and practicable measures" to maintain water quality where it is better than the prescribed objectives. The Subcommittee believes these definitions do not provide an adequate framework to prevent excessive areas of the Great Lakes from remaining in non-compliance or to prevent excessive areas from being downgraded to the objectives in the future. Each objective alone should provide protection from effects of that specific condition, however, the safety factor is very small for some conditions and unknown for others. It cannot be assumed that when two or more minimum conditions (specific numerical objectives) occur simultaneously that protection of use is assured. Antagonistic, additive or synergistic effects may occur. Considering the infinite combinations of water quality characteristics it will never be possible to predict the effects of these combinations even for adult organisms, much less for their life history stages and processes.

The Agreement describes a mixing zone, in part, as an area within which specific water quality objectives shall not apply. Since specific water quality objectives describe the minimum quality of water which will provide for and protect any designated use, it follows that a mixing zone represents encroachment in most cases, a loss of use, a loss

of value, a trade off. The Subcommittee was extremely reluctant to provide specific water quality objectives when no well-defined international-interstate mechanism existed for limiting the present and future loss of value to mixing zones, not only locally but on a waterbody-wide scale.

The Subcommittee recognized that it was not charged with recommending a framework within which water quality objectives can be used to protect against undefined losses of the beneficial uses the Parties desire to secure and protect. However, because the Subcommittee lacked confidence in the limiting mechanisms described above in unquantifiable terms such as "vicinity", "minimum", and "reasonable and practicable", the need for development of a limiting mechanism and a supporting framework was foremost in their deliberations. In the process of assessing, refining and recommending objectives which would accomplish what the Subcommittee interprets as the intention of the Parties, a scientifically defensible limiting mechanism and supporting framework evolved. The proposed objectives are predicated on this framework which is drawn partly from the Agreement, partly from the recommended revisions to the Agreement, and partly from an allocation plan to limit loss of beneficial uses which the Subcommittee suggests is worthy of further consideration and study. To facilitate development of objectives by lending confidence to the Subcommittee that the objectives would be protective of uses, adoption of the framework was assumed. The Subcommittee believes its adoption would aid the jurisdictions in protecting against future losses of the beneficial uses which the Parties desire to secure and protect.

In accordance with Articles IV, V and X dealing with regulatory requirements, remedial programs and implementation

the objectives should serve as a minimum target wherever water quality objectives currently are not met.

In developing specific water quality objectives, the philosophy of protection of the most sensitive use was employed. In most cases, the recommended objectives are established to protect aquatic life or their consumers. Protection of public water supply is employed next in frequency. Aesthetic and/or recreational uses are the most sensitive use for a few parameters.

Carrying the present non-degradation philosophy a step further, the Subcommittee considered that "all reasonable and practicable measures" should be taken not only to maintain existing water quality which is better than the objectives, but that the potential for and the desirability of enhancement should be recognized and provided for. This small alteration in approach encourages further improvement, particularly in the open water areas of the lakes.

The Subcommittee recognizes that any jurisdiction could move toward a more positive non-degradation policy than that provided by taking "all reasonable and practicable measures". To encourage such policies the assumed framework includes the concept of jurisdictionally-designated areas which have outstanding natural resource value and existing water quality better than the objectives within which the existing water quality should be maintained or enhanced.

Specific water quality objectives were designed to be met at the periphery of mixing zones. This assumes water quality conditions better than the objectives will result beyond the mixing zones.

For those contaminants which are non-point source related, are the result of human activity, and do not meet objectives, regulation of the activity itself should be considered in remedial programs.

Water quality criteria on which the present objectives are based were drawn from a data bank which is in a constant state of flux. As new data are developed they are added to this data bank. Because new data may lead to modified recommendations, the objectives should be subject to continual review.

Unfortunately, local biota and local natural or ambient water quality characteristics coupled with a particular objective can result in a different response than assumed by the Subcommittee. The objective may be more restrictive than necessary and, conversely, regulatory agencies should not accept naively that meeting the general and specific objectives guarantees protection of uses. The need for studies of the aquatic environment and effects of conditions on related organisms and uses is not negated by adoption of objectives.

An inadequate scientific data base exists to permit the establishment of scientifically-justifiable numerical objectives for certain unspecified non-persistent toxic substances and complex wastes. To provide a reasonable degree of protection from the potential effects of such substances and discharges, criteria are recommended by which an objective can be developed for local situations. These criteria recommend that specified bioassay tests be conducted on the most sensitive, important local species, and that a stipulated application factor be applied to toxicity data so derived. Such criteria may be termed procedural objectives.

The definition of specific water quality objective in the Agreement includes "---the level of a substance or physical effect --- recognize(d) as a maximum or minimum desired limit---". The Subcommittee interpreted "physical effect" as a purposeful exclusion of biological effects. However, it was felt the Parties intended to consider biological effects since existing objectives include microbiological water quality characteristics and prevention of nuisance growths of algae, weeds and slimes. The Board assured the Subcommittee that the meaning of "physical" included all natural or material things. A clearer definition of specific water quality objective would include "---the concentration of a substance or level of effect---". Because it is difficult to address all "effect" issues by numerical or narrative specific objectives, other means may be necessary to define and achieve a "desired" "level of effect". Such an effect which the Subcommittee identifies as having great potential significance, as the use of nearshore waters of the Great Lakes for cooling water purposes increases, is mortality of passive organisms, especially fish larvae, at water intakes. The Subcommittee's assumed framework includes recognition of limits on levels of all effects as well as the simple concentration of a substance.

The preamble to the Agreement specifically identifies serious concern for trans-boundary effects of water quality deterioration and calls for development and implementation of new and more effective cooperative actions to restore and enhance water quality in the Great Lakes System. The value of the Great Lakes most vulnerable to encroachment by mixing zones is biological because of the fragility and interdependency of the interlocking parts which make up the whole of the Great Lakes ecosystem and the ecosystem of each waterbody. It is obvious to even the casual observer that

there is a limit to loss of fish spawning sites, nursery areas, and feeding grounds before ecosystem imbalance and ultimate collapse of a population occur. Ecosystems are not compartmentalized by jurisdictional boundary lines. If excessive encroachment upon an ecosystem is allowed by one jurisdiction, the loss may impact neighboring jurisdictions which share the ecosystem, certainly a transboundary effect.

The Subcommittee has thoughtfully considered a concept designed to limit biological effects by allocation of biological value loss in mixing zones in such a manner that the biological integrity of the system should be protected. The "desired limit" of biological effect agreed upon should be worked out by the Parties, provinces and states. A high degree of international and interagency cooperation is required and the first reaction of agencies may be to brush it aside as unworkable and too complicated. Of those who have this reaction, the Subcommittee asks, "What other scientifically justifiable alternative do we have?" The method is simplistic when compared with the complexity of the ecosystem.

The Water Quality Board acknowledged the future potential of the biological value allocation mechanism and has authorized further development by referral back to the Implementation Committee and to the Research Advisory Board. Of particular interest to the Board is the availability of the biological data base and costs associated with gathering the missing information, the potential impact on existing dischargers, and the institutional arrangments receiving for implementation.

The major basic components of the mechanism are:

1) Agreement on the biological and other uses to be protected.

2) Identification of the important species.

3) Selection of representative important species whose protection will assure protection of the ecosystem to support the desired uses.

4) Biological mapping of the waterbody, supported by chemical and physical data to establish biotic zones of the representative important species.

5) Assignment of numerical biological value to the zones on the basis of importance to ecosystem function.

6) Identification of loss levels in each biotic zone and total biological value of the waterbody with prediction of consequences to ecosystem integrity.

Major responsibility for development of Steps 2 - 6 should be the responsibility of scientific personnel, while decisions on Steps 1 and 7 - 9 should be the major responsibility of the appropriate agencies charged with resource management.

7) Selection of a level of protection for the waterbody.

8) Calculation of biological value available for allocation.

9) Allocation to present dischargers and reservation for future discharges.

The Subcommittee believes that the institutional arrangement of the IJC provides a forum in which decisions can be made which are critical to the success of this cooperative system to recognize desired limits to biological effects on a waterbody or portion thereof.

To further encourage consistency in management by the various enforcement agencies, the Subcommittee has developed broad guidelines for mixing zones based upon principles of good water management, which describe desirable conditions within and desirable locations for these zones. (See Chapter VI, Appendix A)

This concludes description of the assumed framework within which the Subcommittee believes water quality objectives can be employed to accomplish what the Subcommittee interprets as the intent of the Agreement.

Objectives for Raw Public Water Supply

The intent of the Water Quality Board is to provide for protection of Great Lakes Waters as a raw public water supply which will produce a safe, clear, potable and aesthetically-pleasing water after treatment. It is not the intent of the Board to provide protection of Great Lakes waters for domestic use without treatment. Objectives are not designed to protect this untreated domestic use.

In recommending objectives to protect raw public drinking water supplies, it should be assumed that a minimum level of treatment is provided before distribution to the public for consumption. This minimum level of treatment includes coagulation, sedimentation, rapid sand filtration and disinfection. Often, a numerical objective specified for a contaminant to protect raw public water supplies is the same as an established drinking water standard because:

1) there is inadequate information on the effect of the defined treatment process on contaminant removal; or

2) the defined treatment process is inconsistent in contaminant removal; or

3) the defined treatment process is ineffective in contaminant removal.

The Canadian Drinking Water Standards are presently under review by a National Working Group composed of Federal and Provincial public health and environmental officials. This working group is charged with the responsibility of a complete update of the standards within the next two years.

The Safe Drinking Water Act (PL 93-523) was enacted into U.S. Federal law in December 1974. Proposed National Interim Primary Drinking Water Regulations for the protection of public health were published for comment by the U.S. Environmental Protection Agency in March 1975. These Interim Regulations are scheduled to be promulgated in July 1975 to be effective in December 1976. During this period the National Academy of Sciences is to develop and report on maximum contaminant levels for drinking water by January 1977. Following review and modification, National Primary Drinking Water Regulations are to be promulgated to provide for an effective date not later than March 1979. Additionally, National Secondary Drinking Water Regulations (asthetics) are to be established for application under State regulatory authority.

The Subcommittee did not make recommendations on objectives to protect raw water supplies because of the pending activities described above and extensive expertise in this area is not represented in the Subcommittee. At present there is no basis for recommending changes in the existing standards of the Parties nor have they been examined in detail.

Jurisdictions are currently protecting their raw public water supplies by adopted state, provincial or federal standards. Until the recommendations of the Parties' work groups are known, existing regulations represent the best information currently available. For purposes of surveillance and monitoring to establish indications of non-compliance, the Subcommittee recommends use of the most restrictive of the raw public water supply standards of each country.

FUTURE DIRECTION OF THE WATER QUALITY OBJECTIVES SUBCOMMITTEE

Specific objectives for metals are conspicuously absent from this report. The metals work group prepared several drafts and revisions for mercury, cadmium, copper, zinc, nickel, lead, silver and the organometallics. However, the Subcommittee could not agree that the proposed objectives were scientifically defensible. Rationales or commentary for aluminum, arsenic, fluoride, iron and selenium with tentative recommendations appear in Appendix A. The Subcommittee is reconsidering these objectives and rationales so that all the metals currently under consideration can be presented as a package which will include introductory material pertinent to all metals. The work group has been enlarged, changed to expand the data base and report to the Subcommittee in July. This package, along with numerical specific objectives for several non-persistent toxic substances is expected to be ready for submission to the Board in December 1975.

The Subcommittee will consider for future submission new or revised objectives for the following:

Microbiology - Total and fecal coliform criteria in use for many years are apparently protecting the public health at the clinical level. However, because coliforms are indicator organisms and not causative of a direct adverse health effect, objectives based on their presence may be suspect. The Standing Committee and Health Aspects of the Research Advisory Board would prefer to supplement the microbiology objective with specific organisms to provide a more accurate measure of conditions to protect users. (See commentary, page 157, Appendix A).

Iron - The current objective is not clear as to which form of iron is being identified. Apparently it was developed for soluble iron to meet aesthetic requirements of water distributed in public supply systems. The Subcommittee was ready to propose 0.3 mg/l soluble iron as the objective. Very recently, iron toxicity data was identified which suggested 0.3 mg/l was harmful to aquatic life. Rather than make a hurried decision the Subcommittee will clarify the situation for presentation to the Water Quality Board in July. (See commentary, page 102, Appendix A.)

Asbestos - At the present time there is insufficient data to recommend a meaningful or defensible numerical asbestiform fibre objective for the protection of aquatic organisms or raw public drinking water supplies. (See commentary, page 159, Appendix A).

Phosphorus - Due to the variable response of organisms dependent in part on phosphorus to produce nuisance conditions, justification of a single number for the Great Lakes system is presently not defensible. The Standing Committee on Eutrophication of the Research Advisory Board continues to pursue the possibility of developing an objective. (See commentary, page 195, Appendix A).

Chlorophyll a - The Subcommittee has encouraged the Eutrophication Committee to pursue the possibility of developing a justifiable objective for protection of aesthetics and recreation.

Nitrilotriacetic acid (NTA) - Since this compound is used to some extent in the U.S. and widely employed in detergent formulations in Canada and discharged to municipal sewer systems its presence in the Great Lakes is a certainty. The Subcommittee has not yet evaluated available data.

Detergents - Although the present generation of detergents is biodegradable, their presence in the environment is a certainty. Some data indicate toxic effects in test animals. The Subcommittee has not yet evaluated the available data.

Cyanide - This important toxicant has not yet received the Subcommittee's attention. Negotations are underway to have an outstanding authority on cyanide prepare a background paper.

Toxicity units - The concept of evaluating the damage potential of a wastewater effluent on the basis of toxicity units determined by volume of discharge and toxicity testing has been developed in California. It's applicability and defensibility is being evaluated by both the U.S. and Canadian governments.

Biological effects of intakes - The Subcommittee identifies intake entrainment losses or organisms, especially fish larvae, as a major potential problem and will pursue development of an objective or other desired limits.

Mass balance of critical constituents - This concept has application to the non-degradation objective and the Subcommittee plans to confer with other Reference Groups on the possibility of developing an objective.

Bioaccumulation of fluoride - The literature suggests that fluoride may bioaccumulate. Review is planned to investigate the advisability of further refinement of the objective to limit body burdens.

Nitrogen - Long-recognized as a contributing nutrient to nuisance conditions, a status review is planned.

Total Dissolved Solids (TDS) - Objectives for individual components of TDS will be pursued from the drinking water standpoint and the potential for phytoplankton changes due to increases in TDS will also be investigated. (See commentary page 209, Appendix A).

Radioactivity - A Radioactivity Work Group has been established under the Water Quality Objectives Subcommittee whose terms of reference delineate two general functions:

1) Review of radioactivity objectives and recommendations of any necessary revisions.
2) Review and evaluation of radioactivity monitoring.

The Parties, at their meeting of January, 1973 to assess progress in implementing the Water Quality Agreement, agreed "... to establish a joint working group (the Canadian and the U.S. Advisory Groups) of experts to explore the possibilities for the objective for radioactivity as required in Annex 1, paragraph 7 (b) of the Agreement."

Since that time the Radioactivity Work Group has been developing background information in preparation for its review on behalf of the Board, of the refined objective expected to be presented to Governments by the Advisory Groups during the latter half of 1975.

Mechanism to Limit loss of Beneficial Uses - Further study of the applicability of limiting losses of beneficial uses by allocation of biological value will be conducted with emphasis on identification of important species and representative important species, bilogical mapping including identification of biological zones followed by assignment of numerical bilogical values in each zone and identification of acceptable loss levels in mixing zones as "desired limit" on biological effects. (See commentary, page 227, Appendix A.)

PROPOSED REVISIONS AND NEW WATER QUALITY OBJECTIVES

The Great Lakes Water Quality Board recommends that the following water quality objectives be adopted as common objectives for the Great Lakes. Suggestions for revision or addition to portions of the Water Quality Agreement that pertain to water quality considerations, so that the Agreement is consistent with the conceptual framework employed by its Water Quality Objectives Subcommittee in designing water quality objectives, are presented for consideration in the event that major changes in the Agreement become necessary.

All general objectives, all specific objectives and water quality parameters mentioned in Annex 1, as well as several other parameters, have been considered. Some existing objectives are retained because of their appropriateness, others because there is an inadequate data base to support changes at this time. The objectives which have been modified and the new objectives are considered scientifically defensible at this time. Continued refinement of objectives and development of new objectives will be the future task of the Water Quality Objectives Subcommittee.

It should be emphasized that the objectives as presented below are not designed to stand alone. Questions which arise on reading an objective should be answered in the rationales or by reference to the major supporting literature cited. The supportive rationales for the recommended objectives and revisions, as well as commentary on unchanged objectives, are included in the substantive report of the Water Quality Objectives Subcommittee, Appendix A to this report. The rationales provide justification and are to assure understanding of the approach used by the Subcommittee as endorsed by the Water Quality Board, in developing these

recommendations. It was not deemed practical or logical to provide in this chapter abbreviated rationales for each objective since the rationales are designed to lead the reader through the development process to the conclusion. Each changed or new objective references the rationale in Appendix A.

The recommended revisions to Annex 1 of the Water Quality Agreement are outlined below. The complete Annex is presented in *italics*. Existing wording which is recommended for deletion is enclosed in parentheses. New material is underlined. Explanatory notes not to be included in the proposed revised Annex, are presented in bold face type.

ANNEX 1

SPECIFIC WATER QUALITY OBJECTIVES

1. *Specific Objectives. The specific water quality objectives for the boundary waters of the Great Lakes System are as follows:*

   (a) *Microbiology. The geometric mean of not less than five samples taken over not more than a thirty-day period should not exceed 1,000/100 millilitres total coliforms, nor 200/100 millilitres fecal coliforms. Waters used for body contact recreation activities should be substantially free from bacteria, fungi, or viruses that may produce enteric disorders or eye, ear, nose, throat and skin infections or other human diseases and infections.*

Note: Not revised, see Appendix A, page 157, for rationale.

(b) *Dissolved Oxygen. In the Connecting Channels and in the upper waters of the Lakes, the dissolved oxygen level should be not less than 6.0 milligrams per litre at any time; in hypolimnetic waters, it should be not less than necessary for the support of fishlife, particularly cold water species.*

Note: The Water Quality Objectives Subcommittee has proposed a revised objective for dissolved oxygen, Appendix A, page 183. The Board does not consider that the proposed objective is adequately supported and has referred it back to the Subcommittee for further consideration.

(c) *Total Dissolved Solids. In Lake Erie, Lake Ontario and the International Section of the St. Lawrence River, the level of total dissolved solids should not exceed 200 milligrams per litre. In the St. Clair River, Lake St. Clair, the Detroit River and the Niagara River, the level should be consistent with maintaining the levels of total dissolved solids in Lake Erie and Lake Ontario at not to exceed 200 milligrams per litre. In the remaining boundary waters, pending further study, the level of total dissolved solids should not exceed present levels.*

Note: Not revised, see Appendix A, page 209, for rationale.

(d) *(Taste and Odour. Phenols and other objectionable taste and odour producing substances should be substantially absent.)*

Tainting Substances

1) Raw public water supply sources should be essentially free from objectionable taste and odour for aesthetic reasons.

2) *Substances entering the waters as the result of human activity that cause tainting of edible aquatic organisms should not be present in concentrations which will lower the acceptability of these organisms as determined by organoleptic tests.*

Note: See Appendix A, page 196, for rationale.

(e) *pH. Values should not be outside the range of (6.7) 6.5 to (8.5) 9.0, nor should discharges change the pH at the boundary of the designated mixing zone more than 0.5 units from the ambient.*

Note: See Appendix A, page 191, for rationale.

(f) *Iron (Fe). Levels should not exceed 0.3 milligrams per litre.*

Note: Not revised, see Appendix A, page 102, for rationale.

(g) *Phosphorus (P). Concentrations should be limited to the extent necessary to prevent nuisance growths of algae, weeds and slimes that are or may become injurious to any beneficial water use.*

Note: Not revised, see Appendix A, page 195, for rationale.

(h) *Radioactivity. Radioactivity should be kept at the lowest practicable levels and in any event should be controlled to the extent necessary to prevent harmful effects on health.*

Note: Not revised, pending review of proposed objectives being developed by the Parties.

(i) Persistent Organic Contaminants.

It is recommended, see Appendix A, page 31, that specific objectives be adopted to replace "Interim Objective (c)" quoted below:

> *(Persistent Organic Contaminants. Persistent pest control products and other persistent organic contaminants that are toxic or harmful to human, animal or aquatic life should be substantially absent in the waters.)*

The U.S. Food and Drug Administration has specific limits for a number of persistent organic chemicals and guidelines for others whereas, in Canada, the Department of National Health and Welfare does not have specific limits defined for fish flesh but the intent is to keep the levels to a minimum by controlling users.

> *1) Phthalic Acid Esters*
> *The concentrations of dibutyl phthalate and di-(2-ethylhexyl) phthalate in water should not exceed 4.0 µg/l, respectively, for the protection of aquatic life. Other phthalic acid esters should not exceed the recommended quantification limit of 0.2 µg/l in waters for the protection of aquatic life.*

Note: See Appendix A, page 41, for rationale.

> *2) Polychlorinated Biphenyls (PCB)*
> *The concentration of total polychlorinated biphenyls in fish tissues (whole fish, calculated on a wet weight basis), should not exceed 0.1 micrograms per gram for the protection of fish consuming birds and animals.*

Note: See Appendix A, page 47, for rationale.
The current U.S. Food and Drug Administration's action level for PCB in fish for human consumption is 5 micrograms per gram in edible tissue.

3) *Aldrin/Dieldrin*

The sum of the concentrations of aldrin and dieldrin in water should not exceed the recommended quantification limit of 0.001 µg/l. The sum of the concentrations of aldrin and dieldrin in the edible portion of fish should not exceed 0.3 µg/g for the protection of human consumers of fish.

Note: See Appendix A, page 55, for rationale.
The proposed objective for concentrations in fish is based on the U.S. Food and Drug Administration guidelines.

4) *Chlordane*

The concentration of chlordane in water should not exceed 0.06 µg/l for the protection of aquatic life.

Note: See Appendix A, page 59, for rationale.

5) *DDT and Metabolites*

The sum of the concentrations of DDT and its metabolites in water should not exceed the recommended quantification limit of 0.003 µg/l. The sum of the concentrations of DDT and its metabolites in whole fish, wet weight basis, should not exceed 1.0 µg/g for the protection of fish consuming aquatic birds.

Note: See Appendix A, page 61, for rationale.

6) Endrin

The concentration of endrin in water should not exceed the recommended quantification limit of 0.002 µg/l. The concentration of endrin in the edible portion of fish should not exceed 0.3 µg/g for the protection of human consumers of fish.

Note: See Appendix A, page 64, for rationale.
The proposed objective for concentrations in fish is based on the U.S. Food and Drug Administration guidelines.

7) Heptachlor

The sum of the concentrations of heptachlor and heptachlor epoxide in water should not exceed the recommended quantification limit of 0.001 µg/l. The sum of the concentrations of heptachlor and heptachlor epoxide in edible portions of fish should not exceed 0.3 µg/g for the protection of human consumers of fish.

Note: See Appendix A, page 67, for rationale.
The proposed objective for concentrations in fish is based on the U.S. Food and Drug Administration guidelines.

8) Lindane

The concentration of lindane in water should not exceed 0.01 µg/l for the protection of aquatic life. The concentration of lindane in edible portions of fish should not exceed 0.3 µg/g for the protection of human consumers of fish.

Note: See Appendix A, page 70, for rationale.
The proposed objective for concentrations in fish is based on the U.S. Food and Drug Administration guidelines.

9) Toxaphene

The concentrations of toxaphene in water should not exceed 0.008 µg/l for the protection of aquatic life.

Note: See Appendix A, page 73, for rationale.

10) Methoxychlor

The concentration of methoxychlor in water should not exceed 0.04 µg/l for the protection of aquatic life.

Note: See Appendix A, page 76, for rationale.

11) Other Organic Contaminants

For other organic contaminants, the levels of which are not specified but which can be demonstrated to be persistent and are likely to be toxic, it is recommended that the concentrations of such compounds in water or aquatic organisms be limited to the detection level as determined by the best scientific methodology available at the time.

(j) Unspecified Non-Persistent Substances and Complex Effluents.

It is recommended that the following new specific objective be added:

Unspecified non-persistent toxic substances and complex effluents of municipal, industrial or other origin should not be present in concentrations which exceed 0.05 of the lethal concentration (96-hour LC_{50}) for any approved test species to protect aquatic life.

Note: See Appendix A, page 152, for rationale.

(k) Settleable and Suspended Solids and Light Transmission

It is recommended that a new specific objective be adopted to replace "Interim Objective(d)" quoted below:

> *(Settleable and Suspended Materials. Waters should be free from substances attributable to municipal, industrial or other discharges that will settle to form putrescent or otherwise objectionable sludge deposits, or that will adversely affect aquatic life or waterfowl.)*
>
> *For the protection of aquatic life, waters should be free from substances attributable to municipal, industrial or other discharges resulting from human activity that will settle to form putrescent or otherwise objectionable sludge deposits or that will alter the value of the Secchi Disk depth by more than 10 percent.*

Note: See Appendix A, page 163, for rationale.

(l) Oil and Petrochemicals

It is recommended that a new specific objective be adopted to replace "Interim Objective(e) quoted below:

> *(Oil, Petrochemicals and Immiscible Substances. Waters should be free from floating debris, oil, scum and other floating materials attributable to municipal, industrial or other discharges in amounts sufficient to be unsightly or deleterious.)*
>
> *Oil and Petrochemicals. Oil or petrochemicals should not be present in concentrations that:*
> *1) can be detected as visible film, sheen or discolouration on the surface;*

2) *can be detected by odour;*

3) *can cause tainting of fish or edible invertebrates;*

4) *can form deposits on shorelines and bottom sediments that are detectable by sight or odour, or deleterious to resident aquatic organisms.*

Note: See Appendix A, page 143, for rationale.

In addition to the specific water quality objectives being recommended at this time, the Water Quality Objectives Subcommittee has developed proposed objectives for ammonia (page 117, Appendix A,) chlorine (page 129, Appendix A) and hydrogen sulfide (page 137, Appendix A). The Board, on reviewing these objectives, considered that their adoption would likely have a significant impact on surveillance activities and remedial programs. The Surveillance Subcommittee and Remedial Programs Subcommitee have been directed to provide an assessment of these implications prior to the Board recommending their adoption.

2. *Interim objectives. Until objectives for particular substances and effects in the classes described in this paragraph are further refined, the objectives for them are as follows:*

(a) *Temperature. There should be no change that would adversely affect any local or general use of these waters.*

Note: The Water Quality Objectives Subcommittee has developed a proposed new specific objective for temperature, Appendix A, page 172. However, the Board, before recommending adoption of the objective has requested an assessment of its implications for surveillance and remedial programs.

(b) *Mercury and Other Toxic Heavy Metals. The aquatic environment should be free from substances attributable to municipal, industrial or other discharges in concentrations that are toxic or harmful to human, animal or aquatic life.*

Note: Specific water quality objectives for the metals are being developed.

(c) *Asbestos. Asbestos should be kept at the lowest practicable levels and in any event should be controlled to the extent necessary to prevent harmful effects on health.*

Note: See Appendix A, page 159, for rationale.

The existing Interim Objectives c) Persistent Organic Contaminants, d) Settleable and Suspended Materials and e) Oil, Petrochemicals and Immiscible Substances are superseded by the proposed specific objectives, noted above.

3. *Non-degradation. Notwithstanding the adoption of specific water quality objectives, all reasonable and practicable measures shall be taken in accordance with paragraph 4 of Article III of the Agreement to maintain the levels of water quality existing at the date of entry into force of the Agreement in those areas of the boundary waters of the Great Lakes System where such (levels exceed) water quality is better than that prescribed by the specific water quality objectives.*

Note: See further suggested change, page 161, pending further amendment to the Agreement and Appendix A, page 223, for rationale.

4. *Enhancement. In areas designated by the appropriate jurisdiction as having outstanding natural resource value and which have water quality better than prescribed by the specific water quality objectives, that water quality should be maintained or enhanced.*

Note: See Appendix A, page 223, for rationale.

5. *Sampling Data. The Parties agree that the determination of compliance with specific objectives shall be based on statistically valid sampling data.*

Note: It is recommended that the existing paragraph regarding sampling data be retained and that the Surveillance and Data Quality Subcommittees ensure compliance with its provisions.

6. *Mixing Zones. The responsible regulatory agencies may designate restricted mixing zones in the vicinity of outfalls within which the specific water quality objectives shall not apply. Mixing zones shall not be considered a substitute for adequate treatment or control of discharges at their source.*

Note: The Board is not recommending any change in the above definition at this time. However, guidelines for the designation are under active consideration based on the proposals of the Water Quality Objectives Subcommittee detailed in Chapter VI, Appendix A.

7. *Localized Areas. There will be other restricted, localized areas, such as harbors, where existing conditions such as land drainage and land use will prevent the objectives from being met at least over the short term; such areas, however, should be identified specifically and as early as possible by the responsible regulatory agencies and should be kept to a minimum. Pollution from such areas shall not contribute*

to the violation of the water quality objectives in the waters of the other Party. The International Joint Commission shall be notified of the identification of such localized areas, in accordance with Article VIII.

8. *Consultation. The Parties agree to consult within one year from the date of entry into force of the Agreement, for the purpose of considering:*

(a) Specific water quality objectives for the following substances:

Ammonia	*Copper*	*Oil*
Aresenic	*Cyanide*	*Organic chemicals*
Barium	*Fluoride*	*Phenols*
Cadmium	*Lead*	*Selenium*
Chloride	*Mercury*	*Sulfate*
Chromium	*Nickel*	*Zinc*

(b) Refined objectives for radioactivity and temperature; for radioactivity the objective shall be considered in the light of the recommendations of the International Commission on Radiation Protection.

9. *Ammendment.*

(a) The objectives adopted herein shall be kept under review and may be amended by mutual agreement of the Parties.

(b) Whenever the International Joint Commission, acting pursuant to Article VI of the Agreement, shall recommend the establishment of new or modified specific water quality objectives, this Annex shall be amended in accordance with such recommendation on the receipt by the Commission of a letter from each Party indicating its agreement with the recommendation.

SUGGESTED MODIFICATION TO THE AGREEMENT

Changes or additions are proposed in Articles I, II and III of the Agreement. The Board does not consider these proposed changes to be of sufficient magnitude in themselves to warrant amending the Agreement. However, in the event that major revisions are required in the future, incorporation of the following changes would clarify and improve the concepts presented.

The Board encourages the Parties and jurisdictions to interpret the Agreement with the intent expressed in the proposed changes. The text of the Agreement is presented in *italics* with the additions being underlined and deletions indicated by parentheses.

ARTICLE I - DEFINITIONS

It is recommended that Article I, para (i) be revised to state:

(i) "Specific water quality objective" means the (level) concentration of a substance or level of (physical) effect that the parties agree, after investigation, to recognize as a maximum or minimum desired limit for a defined body of water, or portion thereof, taking into account the beneficial uses of the water that the Parties desire to secure and protect."

Note: See Appendix A, page 14, for rationale.

It is also recommended that the following definition of a general water quality objective be added to Article I, as a new paragraph (m):

(m) *"General water quality objectives" are broad descriptions of water quality conditions which will protect the boundary waters of the Great Lakes System for the beneficial uses that the Parties desire to secure and which will provide overall water management guidance and a framework for the development of the specific water quality objectives."*

Note: See Appendix A, page 14, for rationale.

ARTICLE II - GENERAL WATER QUALITY OBJECTIVES

It is recommended that the general water quality objectives be revised as follows:

The following general water quality objectives for the boundary waters of the Great Lakes System are adopted. These waters should be:

(a) Free from substances that enter the waters as a result of human activity and that will settle to form putrescent or otherwise objectionable sludge deposits, or that will adversely affect aquatic life or waterfowl;

(b) Free from flotsam (floating debris) and other floating materials such as oil, scum, and immiscible substances (as a result of) resulting from human (activity) activities in ammounts (sufficient to be) that are unsightly or deleterious.

Note: See Appendix A, page 18, for rationale.

(c) *Free from materials and heat entering the waters as a result of human activity (producing) that alone, or in combination with other materials, will produce colour, odour, taste, or other conditions in such a degree as to (create a nuisance) interfere with any beneficial uses;*

Note: See Appendix A, page 18, for rationale.

(d) *Free from (substances) materials and heat entering the waters as a result of human activity (in concentrations that are) that alone, or in combination with other materials, will produce conditions that are toxic or harmful to human, animal or aquatic life.*

Note: See Appendix A, page 19, for rationale.

(e) *Free from nutrients entering the waters as a result of human activity in (concentrations) amounts that create (nuisance) growths of aquatic (weeds and algae) plants that interfere with beneficial uses.*

Note: See Appendix A, page 19, for rationale.

ARTICLE III - SPECIFIC WATER QUALITY OBJECTIVES

It is recommended that paragraph 4 of Article III, be revised and a new paragraph 5 be added.

4. *"Notwithstanding the adoption of specific water quality objectives, all reasonable and practicable measures shall be taken to maintain the (levels of) water quality existing at the date of entry into force of this Agreement in those areas of the boundary waters of the Great*

Lakes System where such water quality is better than that prescribed by the specific water quality objectives.

5. *In areas designated by the appropriate jurisdiction as having outstanding natural resource value and which have existing water quality better than that prescribed by the specific water quality objectives, that water quality should be maintained or enhanced.*

Note: See Appendix A, page 23, for rationale.

APPENDICES

A. REPORT OF THE WATER QUALITY OBJECTIVES SUBCOMMITTEE

The Water Quality Objectives Subcommittee has reviewed and commented on all general objectives, all specific objectives and water quality parameters mentioned in Annex 1 of the Great Lakes Water Quality Agreement. Some existing objectives are retained because of their appropriateness, others because there is an inadequate data base to support changes at this time. The rationale and scientific basis for objectives which have been modified and proposed new objectives are presented.

B. REPORT OF THE SURVEILLANCE SUBCOMMITTEE

The Surveillance Subcommittee's report on water quality conditions in the Great Lakes System for 1974 is presented in two parts. The first part is a general assessment of water quality and waste loadings to all parts of the System. In addition to identifying problem areas, the report provides a summary of annual estimates of loadings of phosphorus, B.O.D. and suspended solids from municipalities, industry, tributaries and connecting channels.

The second section provides a detailed assessment of a particular lake and connecting channel. This detailed assessment, while it contains identification of problem areas, is to address particularly the matter of time trends in the lake conditions and an assessment of whether the conditions are improving or not. In accordance with the

schedule drawn up for detailed assessments in annual reports, Lake Erie and the St. Clair River - Lake St. Clair - Detroit River System are addressed in great detail in this year's report. Other lakes will be described in future reports.

In addition to water quality assessment, the need for an international surveillance programs is recognized to address three general categories of problems: the acceleration of eutrophication; concern for the presence and impact of toxic substances in the system; and the impairment of water quality. The remaining section of the report describes a proposal for an interim surveillance plan with emphasis being placed on Lake Erie, Lake St. Clair and the connecting channels.

C. REPORT OF THE REMEDIAL PROGRAMS SUBCOMMITTEE

In this report, the Remedial Programs Subcommittee assesses in detail the effectiveness of the numerous pollution abatement programs (municipal and industrial) in both countries. Current program weaknesses are identified and remedies suggested. The Subcommittee reviews the status of the phosphorus control programs and assesses its short-term impact on the Great Lakes. Activities undertaken by the jurisdictions on the problems of stormwater overflows, sludge disposal, land use, vessel wastes and dredging are described.

The Subcommittee has taken steps to identify geographical locations within the Great Lakes System where the water quality objectives are not being met. In most cases, these "problem areas" are situated at either the mouths of tributaries or in the vicinity of populated urban centres. The Subcommittee has identified the nature of the problem, size

of each affected area whenever possible, probable contributing sources and the status of remedial programs associated with each of these sources. The identification of these problem areas and significant dischargers will provide a baseline for future monitoring and assessment.

Copies of the above Appendices may be obtained from:

International Joint Commission
Great Lakes Regional Office
100 Ouellette Avenue
Windsor, Ontario N9A 6T3
Canada

GREAT LAKES WATER QUALITY BOARD

CANADIAN SECTION

J.P. Bruce (Chairman) (Effective 1974)
Director General
Inland Waters Directorate
Environmental Management Service
Environment Canada
Ottawa, Ontario

D.P. Caplice
Director, Environmental Approvals Branch
Ontario Ministry of the Environment
Toronto, Ontario

D.S. Caverly
Chairman, Environmental Hearing Board
Province of Ontario
Toronto, Ontario

P.M. Higgins
Director General
Water Pollution Control Directorate
Environmental Protection Service
Environment Canada
Ottawa, Ontario

P.R. L'Heureux
Deputy Director
Environment Protection Services
Government of Quebec
Quebec City, Quebec

Captain G. Leask
Director, Central Region Marine Services
Ministry of Transport
Toronto, Ontario

W.A. Steggles
Environmental and Technical Adviser to the Deputy Minister
Ontario Ministry of the Environment
Toronto, Ontario

CANADIAN SECTION - continued

K.H. Loftus
Director, Sport Fisheries Branch
Ontario Ministry of Natural Resources
Toronto, Ontario

R.H. Millest
Director, Water Quality Branch
Inland Waters Directorate
Environment Canada
Ottawa, Ontario

Dr. A.T. Prince (Chairman) (Resigned 1974)
President
Atomic Energy Control Board
Ottawa, Ontario

UNITED STATES SECTION

F.T. Mayo (Chairman)
Regional Administrator, Region V
Environmental Protection Agency
Chicago, Illinois

Dr. R.H. Briceland (Effective 1974)
Director
Illinois Environmental Protection Agency
Springfield, Illinois

T.G. Frangos
Administrator, Division of Environmental Protection
Department of Natural Resources
Madison, Wisconsin

O.H. Hert
Technical Secretary
Indiana Stream Pollution Control Board
Indianapolis, Indiana

W.A. Lyon
Director
Bureau of Water Quality Management
Department of Environmental Resources
Harrisburg, Pennsylvania

G.J. Merritt
Executive Director
Minnesota Pollution Control Agency
Roseville, Minnesota

R.W. Purdy
Deputy Director
Environmental Protection Service
Department of Natural Resources
Lansing, Michigan

E.J. Seebald
Director of Division of Pure Waters
Department of Environmental Conservation
Albany, New York

N. Williams (Effective 1975)
Director
Ohio Environmental Protection Agency
Columbus, Ohio

UNITED STATES SECTION - continued

Mrs. M.L. Leahy (Resigned 1974)
Special Assistant, Bureau of the Budget
State of Illinois
Springfield, Illinois

D.F. Metzler (Resigned 1974)
Deputy Commissioner
Department of Environmental Conservation
Albany, New York

Dr. I.L. Whitman (Resigned 1974)
Director
Ohio Environmental Protection Agency
Columbus, Ohio