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# First Report of Canada Under the 1987 Protocol to the 1978 Great Lakes Water Quality Agreement, December 1988

Government of Canada

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**First Report of Canada  
under the 1987 Protocol  
to the 1978 Great Lakes  
Water Quality Agreement  
December 1988**

**First Report Of Canada  
Under The 1987 Protocol  
To The 1978 Great Lakes  
Water Quality Agreement**

Prepared by:

**The Government of Canada  
and the Government of the  
Province of Ontario under  
The 1986 Canada-Ontario  
Agreement Respecting  
Great Lakes Water Quality**

December 1988

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# Introduction

The Governments of Canada and the United States of America, in 1972 and 1978, entered into Agreements to restore and enhance water quality in the Great Lakes. In 1987, the Governments signed the Protocol amending the Great Lakes Water Quality Agreement of 1978. The signing reaffirmed the Governments' commitment to restore and maintain "the chemical, physical and biological integrity of the waters of the Great Lakes Basin Ecosystem." Further, the Governments are determined to improve on the delivery of Agreement objectives and to demonstrate firm leadership in the implementation of control measures. Despite the complex jurisdictional problems of this undertaking, the Great Lakes Water Quality Agreement demonstrates that binational joint management by Canada and the United States is the best method of protecting the Great Lakes – far better than either country could do on its own.

The Protocol builds on the existing cooperative efforts of Canada and the United States. Its ultimate purpose is to advance the cleanup of the Great Lakes and secure their protection by explicitly addressing all sources of pollution entering the Great Lakes System. Specific improvements seek to control airborne toxics, to deal with contaminated sediments, to designate and remedy particular areas of concern, to reduce pollution from non-point sources, to protect groundwater, and to develop water quality objectives for each of the Great Lakes.

Another significant change resulting from the Protocol is the strengthened public accountability of the Parties. Under the Protocol, the Parties are required to report publicly to the International Joint Commission on the progress of implementation of specific annexes. This document constitutes the first biennial report of Canada under the requirements of the 1987 Protocol. For all of the Annexes which have December 1988 reporting requirements, Canada has reported. As well, progress on implementation of the remaining Annexes has also been included in order to provide the public with an overall picture of Canada's progress.

In Canada, the implementation of the Great Lakes Water Quality Agreement requires federal-provincial cooperation. The Governments of Canada and Ontario recognize their shared responsibility to maintain the aquatic ecosystem of the Great Lakes

Basin and they have provided for this through the 1986 Canada-Ontario Agreement Respecting Great Lakes Water Quality (COA). Under the auspices of the Canada-Ontario Agreement, this report has been prepared jointly with the Province of Ontario.

Requirements of the Agreement falling within federal jurisdiction in Canada are implemented by the federal departments of Environment, Fisheries and Oceans, Agriculture, Transport, National Health and Welfare and the Secretary of State for External Affairs through a federal Great Lakes Working Group. Agreement requirements falling within provincial jurisdiction are implemented by the provincial ministries of the Environment, Natural Resources, and Agriculture and Food.

This report serves to highlight the progress which has been made to date in implementing the revised Agreement. The excellent working relationship that exists among all governments and agencies enhances the Parties' ability to meet their commitments. In the first year of its existence, the Protocol has led to the development of several initiatives which are outlined in the body of this report. Canada has submitted this report to the International Joint Commission and awaits its review and evaluation.



# Highlights

## Specific Objectives

Specific and ecosystem objectives are the yardsticks by which environmental problems in the Great Lakes System are defined and progress is measured. Under the provisions of the Protocol, such objectives are being developed in consultation with the United States. Currently a variety of evaluative techniques are used to characterize polluting substances. To ensure compatibility and consistency in the application of these techniques, the Parties are committed to developing standard methods. Interim standard methods are being used in compiling lists of priority substances to be considered for new specific objectives. Pending agreement on the standard methods, the Parties have identified, under Annex 1, a preliminary list of chemical substances known to have toxic effects and to be present in the Great Lakes System.

The Parties have consulted on revised objectives for toxaphene and selenium and a new objective for 2,3,7,8-tetrachlorodibenzo-p-dioxin, and are prepared to adopt them.

## Remedial Action Plans

Remedial Action Plans are being developed in each of the 17 Canadian Areas of Concern. Teams of federal and provincial experts are assessing the environmental conditions of each area and are identifying area specific problems. These RAP Teams are assisted by public advisory committees made up of representatives of industry, local governments, and citizen groups who help define the specific environmental goals for each area and the actions required to achieve the goals. Canada and Ontario will submit all seventeen plans for review by the IJC in the 1989-1990 fiscal year.

## Lakewide Management Plans

While the Lake Ontario Toxics Management Plan was actually derived from the Niagara River Declaration of Intent, it has nonetheless evolved as a Lakewide Management Plan focussing on toxic chemical contamination. It serves as a useful model for effective interagency cooperation applied to the development of ecosystem based solutions to transboundary contaminant migration. Committees are being established in close cooperation with Great

Lakes activities overall and in consultation with affected jurisdictions and parties. The development of Lakewide Management Plans for the other lakes will be the topic of discussion at a Canada-United States workshop planned for April 1989.

## Control of Phosphorus

Advances are reported in development of control programs for non-point sources of phosphorus under the Soil and Water Environmental Enhancement Program (SWEEP). Progress on the rural and urban implementation of SWEEP programs will be closely monitored.

The Canadian Phosphorus Management Plan affecting municipal, industrial, and non-point sources of phosphorus together with limitations on levels of phosphorus in detergents is being implemented across the Great Lakes Basin. The Lake Ontario Phosphorus Reduction Program will be evaluated in 1990 to confirm whether further controls are needed in light of the positive response of the lake to the controls currently being implemented.

Compliance among the 103 municipal sewage treatment plants is improving from 1986 figures. Industrial sources in the Lake Erie Basin where phosphorus loadings are the most critical were fully in compliance with Agreement requirements.

## Surveillance and Monitoring

Surveillance and monitoring activities have been initiated in support of the development of Remedial Action Plans and Lakewide Management Plans.

The federal-provincial surveillance and monitoring program measures the effectiveness of cleanup efforts, warns of emerging problems and tracks down sources of contamination. It also provides the necessary information to assess the state of the lakes. Originally, the program was designed to carry out the essential components of the Great Lakes International Surveillance Plan (GLISP) of 1975 and it continues to meet those commitments. The environmental quality data gathered under the Plan allows for the assessment of compliance between the water quality objectives of the Agreement and the jurisdictional standards for sources of pollution. Surveillance and monitoring activities are currently underway for the Upper Great Lakes Connecting

Channels Study, the Municipal/Industrial Strategy for Abatement, Remedial Action Plans, and the Niagara River Toxics Management Plan.

As a result of these activities, emerging problems can be identified and long-term trends in the quality of the lakes are being determined. This data constitutes Canada's contribution to the IJC's state of the lakes report.

### **Persistent Toxic Substances**

This year saw the promulgation of the Canadian Environmental Protection Act (CEPA). This Act provides for the comprehensive management of toxic chemicals in all phases of their lifecycle from their development and manufacture, through the stages of transport, distribution, use and storage, to their ultimate disposal. CEPA, in combination with other federal environmental legislation such as the Fisheries Act and the Transportation of Dangerous Goods Act completes the federal regulatory framework. Through federal-provincial agreements under CEPA, currently being negotiated, the federal government contributes to the overall improvement of environmental quality regulation across Canada. This is of direct benefit to the Great Lakes.

The Province of Ontario is implementing the Municipal-Industrial Strategy for Abatement (MISA), the Clean Air Program (CAP), together with measures for waste management and control of pollution from diffuse urban and rural sources. These programs are aimed specifically at controlling discharges of toxic chemicals with the objective of their virtual elimination. In relation to MISA, monitoring regulations for specific industrial sectors are being published to be followed by control regulations for those industries. Under CAP, regulations will be drafted to provide for control of air emissions at the source. Over the next fifteen years, a 50 per cent reduction in the application to land of agricultural pesticides is being sought.

These initiatives by the federal and provincial governments have strengthened the legislative base for toxic chemical controls and have moved Canada closer to the ultimate achievement of the virtual elimination of sources of persistent toxic substances.

### **Non-Point Sources of Pollution**

There has been rapid advancement in program development to address non-point sources of pollution including phosphorus, sediments, toxic substances and microbiological contaminants from land-use activities. Phosphorus control programs have led to advances in the control of bacteria, nitrogen and pesticides from agricultural lands.

New initiatives are being directed at substantial reductions in the use of agricultural chemicals. As well, financial incentives have been introduced to stimulate farmland conservation practices. Wetlands are being classified across the drainage basin and a new province-wide policy on preservation of wetlands has been released for public review.

In urban areas, new initiatives in pollution control planning include sewer use and storm water management. They have the potential to achieve a significant reduction of pollutants from diffuse urban sources.

### **Contaminated Sediment**

Contaminated sediment, especially in harbours and ports, is a major concern in Great Lakes clean-up. The Governments of Canada and Ontario are proceeding with a number of initiatives aimed at improving the management of contaminated sediments. They include research, monitoring and surveillance and pollution control measures. In research, steps are being taken to improve procedures to better assess the environmental impacts of polluted sediments. Monitoring and surveillance activities will inventory the location and quality of polluted sediments in the Great Lakes System. Activities to improve the control and handling of contaminated sediments include evaluation of confined disposal sites and the design of demonstration projects to test new technologies for storing and treating contaminated sediments.

### **Airborne Toxic Substances**

Deposition of airborne toxic substances impacts on the lakes because the atmosphere is a pathway for pollutants and a source of them. The Governments of Canada and Ontario are proceeding with activities which will evaluate existing measuring methods and techniques in order to achieve standardization and improve assessment of the airborne toxics problem.

A master monitoring station is being located at Point Petre on Lake Ontario. Supported by a series of smaller satellite stations, it will be coordinated with monitoring networks established by the province. Parallel efforts are underway in the United States. Both sides will seek to improve measurement methods, network design and data interpretation.

## **Contaminated Groundwater**

Current remedial programs to correct groundwater pollution are continuing and efforts are being made to strengthen them. A coordinated federal-provincial effort will be directed at identifying existing and potential sources of contaminated groundwater together with mapping and standardized approaches to sampling and analysis of groundwater quality problems.

This report is organized to allow the reader to follow the order of the Annexes as they are outlined in the revised Agreement. Details on the issues mentioned above are discussed in their appropriate Annex.

As well, information on all of the Annexes is included in order to provide an overall view of the progress of implementation of the Agreement. Finally, appendices have been inserted to provide details on the federal and provincial programs and activities which are currently underway to meet Canadian obligations under the Great Lakes Water Quality Agreement.



# Annex 1

## Specific Objectives

Specific and ecosystem objectives are the yardsticks by which environmental problems in the Great Lakes System are defined and progress is measured. Specific objectives refer to concentrations or quantities of substances that represent a minimum level of desired water quality. There are many factors which affect the health of ecosystems and specific objectives are limited to the impact of particular substances on particular receptors in the environment. To develop a more comprehensive and integrated measure of ecosystem health, the concept of biological indicators or ecosystem objectives has been introduced which would specify the desired biological or ecological attributes of a system. Under the provisions of Annex 1 of the Protocol, both specific and ecosystem objectives are being developed in consultation with the United States.

**There are three major areas of activity outlined in Annex 1 and the Specific Objectives Supplement:**

- (i) **Compile and maintain three lists of substances, pursuant to the Supplement to Annex 1 paragraph 2(c);**
- (ii) **Specific Objectives**
  - a) **Establish or modify Specific Objectives pursuant to the Supplement to Annex 1 paragraph 2(a)(i);**
  - b) **Establish action levels pursuant to the Supplement to Annex 1 paragraph 2(a)(ii);**
  - c) **Propose new and revised objectives biennially to the Parties pursuant to the Supplement to Annex 1 paragraph 2(a); and**
- (iii) **Develop ecosystem objectives for the boundary waters of the Great Lakes System pursuant to the Supplement to Annex 1 paragraph 3.**

In order to respond to these requirements, the Parties have established a Binational Objectives Development Committee. This Committee has the following tasks:

- (a) Develop standard methods to determine whether a substance is present or has the potential of being discharged into the Great Lakes System and has actual or potential acute or chronic toxic effects on aquatic, animal or human life;
- (b) Using the standard methods agreed to by the Parties, compile and maintain three lists of substances that will guide the Parties, State and

Provincial Governments or the International Joint Commission in proposing a substance for a new specific objective or for modifying an existing objective;

- (c) Recommend to the Parties, for their consideration, new or modified specific objectives;
- (d) Recommend to the Parties, for their consideration, action levels to protect human health based on multimedia exposure and the interactive effects of toxic substances, and
- (e) Develop ecosystem objectives for the boundary waters of the Great Lakes System, or portions thereof, and for Lake Michigan and ecosystem health indicators to assist in evaluating the achievement of the specific objectives for the Great Lakes ecosystem.

## Standard Methods and Lists of Substances

Environmental and health agencies use various measures to assess the effects and environmental fate of substances and thereby set priorities for control. Such measures can include environmental persistence, bioaccumulation, toxicity, mutagenicity and carcinogenicity. The approach taken in evaluating such measures in an assessment process can be complex and can vary amongst agencies. Annex 1 requires the development of standard methods for compiling lists of substances as candidates for consideration in the development of new specific objectives. Reaching consensus on standard methods is a difficult task and the Binational Committee has developed interim methods which are presently being assessed to confirm their suitability and compatibility with procedures employed by the Great Lakes jurisdictions. Pending the conclusion of this assessment, the following preliminary list of substances as required by Specific Objectives Supplement to Annex 1, paragraph 2 (c)(i), has been compiled:

**Preliminary List No. 1 of Toxic Substances in the Great Lakes (for which GLWQA Specific Objectives do not presently exist)**

benzene  
chlorobenzene  
1,2-dichlorobenzene  
1,3-dichlorobenzene  
1,4-dichlorobenzene  
hexachlorobenzene  
1,2,4-trichlorobenzene  
pentachlorophenol  
2,4,6-trichlorophenol  
2-chloronaphthalene  
1,2-dichloropropane  
carbon tetrachloride  
chlorodibromomethane  
chloroform  
chloromethane  
1,1-dichloroethane  
1,2-dichloroethane  
dichloromethane  
hexachloroethane  
1,1,2,2-tetrachloroethane  
tetrachloroethylene  
tribromomethane  
1,1,2-trichloroethane  
trichloroethylene  
hexachlorobutadiene  
hexachlorocyclopentadiene  
n-nitrosodiphenylamine  
acenaphthene  
acenaphthylene  
anthracene  
benz(a)anthracene  
benzo(b)fluoranthene  
benzo(k)fluoranthene  
benzo(g,h,i)perylene  
benzo(a)pyrene  
dibenz(a,h)anthracene  
fluoranthene  
fluorene  
indeno(1,2,3-cd)pyrene  
naphthalene  
phenanthrene  
pyrene  
toluene  
antimony  
beryllium  
thallium

These substances have recognized toxic effects and are common to the priority pollutant lists of the Ontario Ministry of the Environment and the United States Environmental Protection Agency. In addition, they have been identified by the Great Lakes

Water Quality Board as being present in the Great Lakes System.

**Specific Objectives**

Since 1978 the IJC and its committees have recommended various new and revised specific objectives for Great Lakes water quality. The Parties have consulted on the following objectives and are prepared to adopt them:

**Toxaphene (revised objective)**

The concentration of toxaphene in water should not exceed 0.0002 micrograms per litre for the protection of human consumers of fish.

**Selenium (revised objective)**

Concentrations of total selenium in unfiltered water samples should not exceed 1 microgram per litre to protect aquatic life. Concentrations in sediments should not exceed 5 micrograms per gram to protect aquatic life. Concentrations in aquatic biota should not exceed 3 micrograms per gram (wet weight basis) to protect predatory fish and mammals.

**2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) (new objective)**

For the protection of all life forms TCDD should be absent from all compartments of the ecosystem including air, land, water, sediment, and biota. Absent means not detectable as determined by the best available technology.

**Ecosystem Objectives**

The Binational Objectives Development Committee will also proceed to develop ecosystem objectives. Prior to the signing of the Protocol in 1987 this activity was conducted by the IJC Aquatic Ecosystem Objectives Committee (AEOC) which is currently concluding its previous assignment. In future, the Boards of the IJC will evaluate the ecosystem objectives adopted by the Parties and offer pertinent advice.



# Annex 2

## Remedial Action Plans and Lakewide Management Plans

The 1987 Protocol commits the Parties to the development and implementation of systematic, ecosystem based strategies to restore and protect beneficial uses in Areas of Concern or in open lake waters. Provisions for development of these strategies are made in Annex 2 of the Protocol and are supported by surveillance and monitoring activities under Annex 11.

### I. Remedial Action Plans

The Parties, in cooperation with State and Provincial Governments, are required to do the following in order to develop and implement Remedial Action Plans:

- (i) designate geographic Areas of Concern;
- (ii) develop and implement RAPs for Areas of Concern according to guidelines in Annex 2 (Section 4(a));
- (iii) consult with the public and all affected State, Provincial and Municipal Governments in the development of RAPs;
- (iv) submit Remedial Action Plans to the International Joint Commission for review and comment at three stages of development (Section 4(d)), and
- (v) report biennially, beginning December 1988, to the International Joint Commission on the progress in developing and implementing Remedial Action Plans.

**Table I\***  
**Canadian Areas of Concern**  
**Remedial Action Plan Status - December 1988**

Location	IJC Stage I Report Target		IJC Stage II Report Target
	Jan-Mar 1989	Apr-Dec 1989	(Quarter)
Thunder Bay		X	3 Qtr 1990
Nipigon Bay		X	1 Qtr 1990
Jackfish Bay		X	2 Qtr 1990
Peninsula Harbour		X	2 Qtr 1990
St. Marys River**	X		4 Qtr 1990
Spanish River		X	3 Qtr 1989
Severn Sound	X		3 Qtr 1990
Collingwood Harbour	X		1 Qtr 1990
St. Clair River**	X		3 Qtr 1990
Detroit River**	X		3 Qtr 1990
Wheatley Harbour	X		3 Qtr 1989
Niagara River***		X	1 Qtr 1991
Hamilton Harbour	X		3 Qtr 1989
Toronto	X		4 Qtr 1990
Port Hope	X		2 Qtr 1989
Bay of Quinte	X		3 Qtr 1989
St. Lawrence River***	X		2 Qtr 1990

\*According to Section 4 (d) of Annex 2 the Remedial Action Plans shall be submitted to the Commission for review and comment at three stages:

- I. When a definition of the problem has been completed;
- II. When remedial and regulatory measures are selected; and
- III. When monitoring indicates that identified beneficial uses have been restored.

\*\* These RAPs are binational with the United States.

\*\*\*The establishment of binational RAPs is being discussed.

There are 17 Areas of Concern on the Canadian side of the Great Lakes for which the federal and provincial governments are cooperatively developing Remedial Action Plans. Twelve are wholly within Canada and five are shared with the United States. These are being developed under the direction of a Canada-Ontario Agreement (COA) RAP Steering Committee and 17 RAP Teams, each with participants from the various federal and provincial agencies.

Extensive public involvement in the Remedial Action Plan process is provided through close liaison with local stakeholders (municipalities, industries, aboriginal peoples, universities, interest groups and the general public). The results of this liaison are a clear definition of the water use goals which are affected by water quality degradation, and the development and evaluation of remedial options, whose costs are expected to be substantial, to achieve these goals. Guidelines and public information programs have been developed for use by public advisory committees.

The COA Board of Review submitted reports to the IJC in May 1987 identifying the status and direction for the development of each RAP. This information was published in the November 1987 Great Lakes Water Quality Board Report to the IJC. The status reports included a brief description of environmental conditions, a statement of progress in developing the RAP, and a tentative timetable for RAP completion.

Remedial Action Plans are to be submitted to the IJC for review and comment. By 31 March 1989 eleven of the seventeen Canadian RAPs will have Stage I reports available for submission to the IJC. All 17 RAP Teams will have submitted Stage I reports to the IJC by 31 December 1989. Table I is included to summarize the planned development stages of the Areas of Concern. The following is an update on progress of development and implementation, by Area of Concern, for each of the Canadian and Binational RAPs.

### **North Shore of Lake Superior Remedial Action Plans**

Thunder Bay, Nipigon Bay, Jackfish Bay and Peninsula Harbour have been grouped together as the North Shore of Lake Superior Remedial Action Plans. Work continues on updated environmental conditions and problem definition for the four areas of concern. Summaries of these reports are currently available to interested stakeholders.

A general introductory brochure has been developed on the four areas of concern which is consistent with the unified theme. Other documents and public

information materials have been prepared for use in the public involvement process. The first open house took place in Nipigon Bay in November 1988. Others will follow.

### **Thunder Bay**

A number of technical studies have been undertaken to update information on environmental conditions and sources of pollutants in Thunder Bay Harbour. These include:

- Dissolved oxygen monitoring of the Kaministiquia River flowing into Thunder Bay Harbour (1987-1988);
- Chippewa Beach Bacterial Contamination;
- Contaminants in sportfish (1988);
- Salmonid Populations on the Kaministiquia River;
- Kaministiquia River Fish Habitat;
- Thunder Bay Fisheries Assessment, and
- Kaministiquia River Water Quality.

Monitoring and measuring of point source discharges and ambient conditions, as well as measuring currents in Thunder Bay, are conducted regularly. Data will provide input to a hydrodynamic model to define the extent of the impact of point source discharges on the nearshore area.

### **Nipigon Bay**

The following studies have been completed for the Nipigon Bay RAP to update the definition of the environmental problem and pollutant sources:

- evaluation of sediment quality in the vicinity of the Red Rock water supply intake (December 1987);
- assessment of potential effects of leachate from the Domtar Packaging mill's wood waste disposal sites and clarifier sludge disposal sites in Red Rock (December 1987);
- response of benthic macroinvertebrates to water quality improvements in Nipigon Bay (December 1987);
- continuous toxicity testing at Domtar Packaging Ltd. The results of this program indicate that Domtar is meeting requirements for acute toxicity.
- contaminants in sportfish, and
- survey of bottom sediments in depositional areas, and of suspended sediments at sources (August 1988).

### Jackfish Bay

The following studies have been completed for the Jackfish Bay RAP in order to update the definition of the extent of environmental impacts:

- 1988 Fish Contaminant Survey to be published in the 1989 Guide to Eating Ontario Sport Fish;
- sediment sampling;
- sonar survey of the bottom for selected portions of Jackfish Bay to identify depositional zones and sediment types;
- evaluation of the benthic community in Jackfish Bay (1969, 1975 and 1987); and
- regular effluent testing, including toxicity, at the Kimberly-Clark Ltd. pulp mill.

### Peninsula Harbour

Effluent toxicity testing is occurring in order to complete the environmental data base for the Peninsula Harbour RAP. The following draft reports are available:

- preliminary assessment of leachates from the James-River Ltd. wood waste site was completed in 1987 (the production of phenols and a concentrated leachate from the wood waste disposal site was confirmed); and
- study of the sediment and water quality was conducted in Peninsula Harbour (1984-1985).

### Spanish River

Field studies completed in 1987/1988 include water quality monitoring, sediment bioassays and angler/creel surveys. Additional field work undertaken to complete the environmental data base includes a sediment and benthic survey, and a bioaccumulation study. Supporting trace contaminant coring and radioactive dating (PB-210) is scheduled. Fisheries habitat and fish contaminant surveys were initiated in July and August 1988.

In 1983, E. B. Eddy Forest Products Limited installed secondary treatment facilities at the Espanola mill. The results have shown marked improvements in water quality, the fishery and habitat. These results have been confirmed by water quality monitoring, creel assessment and benthic surveys carried out on the river. Laboratory taste tests conducted in January 1987 confirm the degree of tainting to be significantly reduced relative to studies carried out in 1980. However, some degree of tainting would still appear to be evident based on comments received through the public participation program.

Studies are being undertaken to assess the eutrophication status of the harbour and the bacteriological quality of the reach downstream of Espanola.

The impact of the Espanola sewage treatment plant on the bacteriological status of the river is under study, as are the potential impacts of chlorinated phenols, dioxins and dibenzofurans from E. B. Eddy Forest Products Limited on fish communities. The biological impact of elevated sediment contaminant levels is also being evaluated. The feasibility and impact of navigational dredging in the approach channel to Spanish Harbour is under study.

Major stakeholders were contacted and a series of public information sessions were held in August, 1988. Questionnaires have been distributed to confirm the state of the river's use and to identify use impairments. The results of this survey will be collated and made public. Public meetings started in November 1988.

### Severn Sound

Field studies currently underway in the Severn Sound Area of Concern include assessment of sediments, tributaries, and agricultural watersheds as sources of nutrients, a water exchange study, and fisheries assessment (creel survey, index netting, walleye hatching success, nursery habitat). A report, **Severn Sound Remedial Action Plan: Part I Environmental Conditions and Problem Definition**, indicates that very little trace contamination is present in Severn Sound. Eutrophication remains the key environmental problem.

Public information and education is proceeding via three routes: use of a display booth at local events (fishing derbys, fairs, community gatherings); meetings held with organized groups for active solicitation of stakeholders (eg. municipal information workshop held June 1988); and public meetings. A newsletter and fact sheets were released in June 1988.

### Collingwood Harbour

A status report for the Collingwood Harbour RAP, describing the area of concern, environmental conditions, and progress on the public involvement process is being prepared. The report will be available to interested stakeholders. Extensive field studies were conducted in 1986 and 1987 as outlined in the original model draft RAP submitted to the IJC in 1986. Efforts in 1988 concentrated on data analysis and reporting to complete the description of environmental conditions and pollution sources as required for the first stage report to IJC. Environmental quality and water use goals are expected to be established in January 1989.

Public information on the RAP process and current environmental conditions of Collingwood Harbour was distributed in 1988. A newsletter outlining the current status of the harbour and the RAP was published and distributed prior to a public forum in April 1988 and presentation to Collingwood Town Council. This was followed by an information activity called "Harbour Day" in October 1988, attended by over 300 people.

The RAP Team established a public advisory committee in September 1988. Their initial meeting was held in November 1988.

## **Wheatley Harbour**

Progress on the Wheatley Harbour RAP has been made on several fronts. First, work continued on sampling and documenting environmental conditions. Second, some measures to improve water quality were undertaken. Finally, the public involvement program commenced.

Since the 1987 Status Report, the following technical studies have been completed: clam bio-monitoring, aquatic invertebrate studies, whole fish and edible portion contaminant analysis, laboratory uptake studies (using fish and mayflies), Cladophora bio-monitoring, dissolved oxygen profiling, and routine water sampling of the harbour, effluent discharges and upstream drainages.

With regard to the public involvement program, a questionnaire was distributed to local residents to determine attitudes and impressions about Wheatley Harbour. This was followed by a meeting with local elected officials, an open house, distribution of a newsletter and a public meeting. Fact sheets on Area of Concern issues were written and distributed at the public meetings. Formation of a Public Advisory Committee is now being considered.

In response to the comments received regarding garbage in the upstream Muddy Creek Wetlands, a "Students Cleaning Our Urban Rivers" crew, an Ontario Government Program, cleaned up the debris from the wetlands and beach.

A conceptual design report was prepared on upgrading of the sewage treatment facility, the only remaining point source discharger to the area. It is expected that the proposed modifications to the existing treatment facility will improve the environmental conditions in Wheatley Harbour.

## **Hamilton Harbour**

The assessment of environmental conditions in the harbour has been completed and published in a discussion document for public review. The primary focus of the document is on water and sediment

quality and on contaminants in fish. Where data were available, information on related environmental matters such as fish populations and habitat, and wildlife and water birds have been included.

While the assessment has been completed, additional studies are being carried out to evaluate the effectiveness of proposed remedial options. These include:

- further assessment of the sources and biological effects of contaminated sediments;
- assessment of in-situ treatment of contaminated sediments;
- feasibility of proposed ammonia and phosphorus treatment at the Hamilton sewage treatment plant;
- intensive fish and fish habitat study of the Harbour;
- analysis of the water exchange between the bay and Lake Ontario for its impact on water quality, and
- fecal coliform testing to establish general near-shore levels and the reasons for their variation.

Three major studies have been completed in 1988: a socio-economic study of the several remedial options proposed (including a numerical model of the impact of ammonia and phosphorus control on hypolimnetic oxygen); a study of the source of suspended sediments to tributaries in the rural areas of the basin, and a determination of the sources of water clarity problems.

A number of plans are expected to be completed in 1989:

- (i) the Regional Municipality of Hamilton-Wentworth is preparing a plan for completion of a combined sewer overflow remediation program;
- (ii) the RAP Team, in conjunction with the Regional Conservation Authority, will be developing a plan for control of suspended solids loadings to the west end of the Harbour; and
- (iii) the Ontario Ministry of the Environment is developing a pilot plan for a computer-assisted storm event control system to optimize sanitary and storm sewer operation in the area.

Intensive monitoring of the harbour and its tributaries has been undertaken from 1986 to 1988 to establish baseline environmental quality data. A monitoring program has been designed for ambient water quality, sewage treatment plant effluents, fish, wildlife, sediments and tributary loadings. Effluent and process monitoring regulations under the Ontario Municipal-Industrial Strategy for Abatement (MISA) are expected to be in effect by mid-1989.

As well, a funding agreement has been established to clean-up a contaminated sediment problem in Windermere Basin.

The steel industry continues to implement measures designed to reduce contaminant loadings to the harbour. Dofasco Inc. will be undertaking diversion of biological treatment plant effluent to the municipal sewage treatment plant in 1989. Plans are in place to recirculate Dofasco's blast furnace gas cleaning wastewater in 1989.

The loss of marsh in the harbour has been of concern to many. On 23 June 1988 the Board of the Royal Botanical Gardens approved a project to restore the marsh in Cootes Paradise with the help of Ducks Unlimited. However the project is still subject to approvals by regulatory agencies. Restoration is planned for the fall of 1989 and will take three months to complete at a cost of \$1.25 million.

In March 1988 the report *Goals, Problems and Options* was released and submitted to Stakeholders. The report was considered at a public meeting in May 1988 and a Stakeholders' meeting in October 1988. It will form the basis of discussions between the Writing Team and Stakeholders leading to determination of the preferred remedial options in early 1989. Commitments for implementation will then be sought.

## Toronto Harbour

The emphasis in the last year has been on the establishment of a public information program and the development of a public advisory process. The public information program has been aimed at informing the public about the RAP process and providing opportunities for community involvement. The public advisory process has been aimed at gaining public input in goal setting.

Program activities have included distribution of a brochure and newsletters, poster display, and fact sheets on beaches, fish consumption, aesthetics and drinking water. During the spring of 1988, meetings were held with the Metro Toronto Waterfront Remedial Action Committee, environmental, conservation, recreation and community groups, and individuals interested in the development of the Toronto Harbour RAP.

The public involvement program consists of the production of reports and discussion papers, and the sponsorship of a workshop to review reports, set goals, and review ongoing remedial programs. The

workshop, held in October 1988, discussed the following documents:

- Environmental Conditions and Problem Definition Report
- Discussion Paper on Goals
- Discussion Paper on Existing Remedial Programs
- Reference List

The Centre for the Great Lakes was contracted to conduct the workshop, held in October 1988 at which more than 100 individual and group participants discussed water use goals and objectives and the progress of remedial measures.

Municipalities within the study area have been requested to nominate representatives to the public advisory process, and provide staff to act on a technical advisory committee. Two municipal representatives will be added to the RAP Team and a representative of the public may also be added in the future.

Studies and remedial actions have been undertaken and are ongoing in the Metro Toronto region. These include:

- river quality management plans for the Humber and Don Rivers, and
- implementation of remedial measures (sewer separation projects and detention tanks) under the Metro Toronto Waterfront Water Quality Improvement Program.

## Port Hope

The first stage report on problem definition has been completed and will be submitted in the first quarter of 1989.

The Port Hope Harbour RAP Public Involvement Program has been emphasized over the last year. The program consists of meetings with the Port Hope Environmental Advisory Committee, a newsletter, articles concerning Port Hope Harbour RAP in the Low Level Radioactive Waste Management Office of Atomic Energy of Canada Ltd. (AECL-LLRWMO) newsletter and providing information packages on the RAP to all interested Port Hope area residents.

A RAP Community Information Workshop was held in March 1988. It was attended by over 40 individuals and stakeholders. The workshop provided the stakeholders with the opportunity to express opinions on use goals and the public involvement process. Public consultation and stakeholder discussions will continue with the objective of submitting the RAP to the IJC by June 1989.

Detailed plans for sediment removal have been developed by the LLRWMO. The Whiteshell Nuclear

Research Establishment of AECL has completed a small scale in-situ demonstration project and supporting laboratory program to confirm the viability of the recommended clean-up method for the harbour (clamshell dredging followed by suction dredging of residual sediment). The project will ensure that the clean-up method for the harbour will not pose any unacceptable environmental risks. The demonstration project's clamshell dredging was completed in the fall of 1987. The test area was left until June 1988 when the hydraulic cleanup process was undertaken. A summary report containing analytical results and remedial action recommendations is scheduled to be completed late in 1988.

The National Water Research Institute (NWRI) of Environment Canada is conducting a field study to determine contaminant loadings of sediments to the Port Hope Harbour. This study will give an indication as to the potential for recontamination of harbour sediments following the cleanup. It is based on the continuance of present loadings.

The implementation of the proposed remedial action for Port Hope Harbour is dependent on the establishment of a low level radioactive waste disposal facility. A special task force was established in 1986 to identify the siting process by which candidate sites will be selected. The Siting Task Force has been given an 18-month mandate to implement several of the recommendations in the first phase of the report entitled, *Opting for Co-operation*. The siting process is anticipated to take three to five years to complete. Following this, the construction of an operational waste disposal facility will begin. This facility will be capable of receiving sediments from Port Hope Harbour.

## Bay of Quinte

The public information and involvement component of the RAP is being jointly handled by the RAP Team and a 21 member Public Advisory Committee with the assistance of a consultant-facilitator. Several approaches have been employed throughout the development of the RAP to inform and involve the public. These have included: public meetings, information booths, newsletters, questionnaires, and presentations, plus routine media coverage. The final phase will involve consultation with the public concerning the options for remedial action.

The RAP Team produced a progress report in January 1987 which documented ecosystem status, data gaps, impaired uses, concerns and restoration objectives together with a list of potential remedial options. Following the release of the report, a series of technical studies and consultant's evaluations were initiated to complete the ecosystem assessment and

examine cost and feasibility of the potential remedial options. These are being published by the RAP Team as a series of technical reference documents for the RAP. The studies include:

- evaluation of municipal and industrial point source loadings;
- evaluation of diffuse source contaminant loadings at the Bay;
- evaluation of landfill sites as sources of persistent toxic contaminants;
- evaluation of phosphorus sediment flux;
- evaluation of toxics data base;
- toxics studies for water, sediments, and biota, and
- bacteriological studies.

During 1988, scientists, resource managers, consultants and members of the public advisory committee participated in two ecosystem modelling workshops. The purpose of the workshops was to construct a conceptual model of the ecosystem linkages and develop, to the extent possible, predictive numerical models which would allow an integrated evaluation of anticipated ecosystem responses to potential remedial measures.

The final phase of information synthesis, a socio-economic study, is now in progress. It will include a comparative assessment of the potential remedial measures options and their cost-effectiveness.

## Bi-National Remedial Action Plans

There are five RAPs which Canada shares with the United States. They are the St. Marys River, St. Clair River, Detroit River, Niagara River and St. Lawrence River Areas of Concern.

In 1985, Governor Blanchard of Michigan and Premier Peterson of Ontario signed a "Letter of Intent" which committed both parties to develop joint RAPs for the St. Marys, St. Clair and Detroit Rivers Areas of Concern. In the cases of the St. Marys River and the St. Clair River Areas of Concern, Ontario is designated as the lead agency. Michigan is the lead agency for the development of the joint RAP for the Detroit River Area of Concern. Technical data and ground-work for the development of RAPs for these three binational areas will be provided by the Upper Great Lakes Connecting Channels Study (UGLCCS). The UGLCCS is a bi-national study initiated to determine the environmental conditions of the rivers and to make recommendations for remedial action. The UGLCCS is scheduled for completion in December 1988.

Federal and provincial agencies in Canada have initiated a RAP for the Canadian side of the Niagara River. New York State will pursue a separate RAP for the American side of the river. Consultation between Canada and the United States will occur at various stages of the development of the RAP.

In the case of the St. Lawrence River Area of Concern, Canada and Ontario agreed with New York State on the preparation of a joint statement of the problem and coordination of preparation of the respective RAPs at various critical stages.

### **St. Marys River**

Aside from the UGLCCS, technical data will be forthcoming with the completion of the Municipal-Industrial Strategy for Abatement (MISA) Pilot Site Study in early 1989. This study assesses the water-base impacts of the iron and steel sector on the St. Marys River. The UGLCCS and MISA study reports, along with numerous specific studies of the St. Marys River, will provide a comprehensive data base upon which to develop the RAP.

The binational RAP Team has met every two months. Much of its effort has concentrated on developing the public involvement program. A consultant was retained to coordinate and help develop the program which has included establishing a contact list of approximately 500 individuals, hosting and participating in six public meetings and shows, and helping to develop the binational public advisory council (BPAC).

In November 1988, the BPAC met for the first time. It is comprised of 37 members; 18 from the United States and 19 from sectors of the community in Sault Ste. Marie. It is comprised of sector groups with a diversity of interests. The BPAC will rely on consensus building to ensure that the concerns and priorities of the community are conveyed to the RAP Team for incorporation into the Draft RAP.

The development of the RAP has not precluded the initiation of abatement measures. A coal tar spill in Bennett Creek, a tributary to the St. Marys River, was discovered in May 1987. An immediate cleaning of free-phase coal tar was initiated, and Algoma Steel and Domtar continue to investigate the extent of contamination and to develop an amelioration strategy. Other abatement measures required under the MISA Program, Control Orders and other regulatory requirements for Algoma Steel, St. Marys Paper Company and municipal water pollution control plants are proceeding while the RAP is being developed.

### **St. Clair River**

The RAP Team has made significant progress in establishing a public involvement program which is an integral part of the RAP development. The first public meeting was held in Sarnia in February 1988. At this meeting, the RAP Program was discussed in terms of its purpose, goals and objectives together with the need for adequate and meaningful public input. A stakeholders list containing over 500 individuals has been compiled.

In March 1988 a BPAC was created to advise the RAP Team. This Council consists of 46 members from the agricultural, business, environmental, medical, governmental, recreational and labour sectors and the general public of both countries. The BPAC met on three occasions between April and September 1988.

In June 1988, the Ontario Government established, under the auspices of the Municipal-Industrial Strategy for Abatement (MISA), a petroleum refinery sector monitoring regulation. This regulation requires petroleum refineries to monitor process wastewater discharges for one year prior to the development of the compliance regulation which will be based on best available technology economically achievable. Additional technical data for the development of the St. Clair River RAP will be forthcoming from the MISA Pilot Site Study, initiated in 1986, and now in the writing phase. Report delivery is scheduled for late 1988.

### **Detroit River**

The Detroit River RAP Team has made steady progress in the development of the RAP for this Area of Concern. Most notable has been the establishment of a comprehensive binational public involvement program. In addition, the RAP Team has made progress in the definition of historical problems in the river and has outlined these problems to the public. This report is available from Limno-Tech Incorporated of Ann Arbor, Michigan.

The public involvement program has been developed jointly by the United States and Canadian members of the RAP Team. The Michigan Department of Natural Resources has retained the services of the Southeast Michigan Council of Governments (SEMCOG) to oversee the RAP program in its capacity as the lead agency. The Ontario Ministry of the Environment retained a consultant to work with SEMCOG on public involvement. Several public meetings have subsequently been held in both Canada and the United States.

The first public meeting was held in Windsor in June 1987. The RAP process was introduced and the public's views were sought on environmental problems in the Detroit River. The second public meeting was held in October 1987 in Detroit. This meeting provided an update on the progress of the UGLCC Study. The most recent public meeting was held in Windsor in June 1988 with a focus on the question of toxic substances and their effect on fish, drinking water and human health.

In addition, a BPAC was created in December 1987. It consists of 40 members from the academic, environmental, industrial, labour, recreational, governmental sectors and the general public. The BPAC met on four occasions between January and July 1988. It has adopted a framework for consensus building and initiated a discussion of water quality issues in the Detroit River.

To publicize the Detroit River RAP, two weekends of special events were held in September 1988. Activities included fishing derbies, folk music, poster displays and ship tours. The event, called Detroit River Celebration '88, drew attention to the RAP program and the value of the river. Over 3500 people participated in the fishing derbies alone.

### Niagara River

Public meetings in Canada are scheduled to begin in November 1988 to present environmental information on existing conditions. Meetings will be held in January and February 1989 to determine the public's view on impaired uses and restoration. A public advisory committee is in the initial stages of being organized. Individuals representing six sectors are being contacted to determine the level of interest in participating on a PAC.

In February 1987, the heads of the two federal, and the provincial and state environmental agencies with responsibilities for the Niagara River signed the 'Declaration of Intent for the Niagara River.' In that document, the Parties committed their agencies to applying the full extent of their jurisdictional rules and regulations to a cleanup program for the River.

The Declaration provides for a 50 per cent reduction in loadings of certain persistent toxic substances by 1996, using a prescribed work plan and the 1986-1987 point source discharge monitoring data as a baseline. These reductions would be realized through the activities outlined in the previously negotiated workplan. Together, the Workplan and the Declaration of Intent form the Niagara River Toxics Management Plan (NRTMP).

It is expected that the Remedial Action Plan developed for the Niagara River Area of Concern will incorporate many of the aspects of the NRTMP. However, it is first necessary to define all of the impaired uses and desired goals. A reassessment of whether the NRTMP adequately addresses the remediation goals identified in the RAP process will be necessary. Non-toxics issues such as local problem areas (localized restricted areas) and contamination by conventional pollutants and bacteria will have to be addressed within the RAP to complement the work on toxic contamination.

The Ontario Ministries of Environment and Natural Resources and Environment Canada have initiated a number of studies to develop a RAP for the Niagara River and to meet the requirements of the NRTMP. These studies include:

- annual monitoring of a wide range of conventional and toxic contaminants from all point source discharges;
- detailed investigations at all landfills identified in the Niagara River Toxics Committee (NRTC) report and estimation of the loading of contaminants to the Niagara River from these sources;
- annual biomonitoring of contaminants using freshwater clams, leeches, Cladophora and spot-tail shiners;
- year-round intensive monitoring of ambient river chemical concentrations at Fort Erie and Niagara-on-the-Lake;
- monitoring of chemical concentrations in raw and treated drinking water at filtration plants in the Niagara Peninsula;
- sampling and analysis of sport and forage fish flesh for toxic contaminant body burden and establishment of consumption advisories where required;
- determination of loading of contaminants to the Niagara River from Ontario-based tributaries through the implementation of a detailed 12-month intensive investigation and analysis program, and
- estimation of contaminant loading to the Niagara River from landfills identified in the NRTC report as being potentially significant sources of contamination.

The NRTMP has a public involvement component which meets some of the objectives of the RAP process. NRTMP public meetings serve to present current programs and report progress specific to the plan. They have occurred on a semi-annual basis since January 1987. Additional public information sessions will occur in accordance with the NRTMP requirements and schedule. The Ontario Ministry of Natural Resources has also held public involve-



ment sessions on the Lake Ontario Fisheries Management Plan. It is anticipated that portions of this plan which relate to the Niagara area will be included in developing the fishery component of the Niagara River RAP.

### **St. Lawrence River**

In the area of Cornwall, pollution from conventional contaminants such as nutrients (phosphorus and nitrogen) and bacteria is no longer the major concern. Persistent contaminants (PCBs and mercury) are now the primary cause of impairment. Other causes include habitat loss, overfishing, and excessive weed growth.

The RAP Team has been working since 1986 to analyse and complete the data on environmental conditions and sources in the Cornwall-Massena-Lake St. Francis area. The work has included coordination with Environment Canada, Environment Quebec, the U.S. Environmental Protection Agency, New York State Department of Environmental Conservation and the Mohawk people at Akwesasne.

In 1988, field studies were carried out under the RAP program to measure contaminant levels in water, suspended sediments (ambient and effluent), caged mussels, bottom sediments and spottail shiners. In addition, sport fish were collected for the Ministry of Natural Resource's Index Program, and Creel Census was done which included a tainting survey. Contracts to study weeds in Lake St. Francis and collect sportfish for contaminant analysis were undertaken. An analysis of fish tumors was planned, however, no tumors were found. Other field work, not under the direction of the RAP Program, included contaminant measurement in indigenous mussels and sportfish.

With the exception of potential impacts on migratory fish populations, discharges or residual inputs from the Cornwall area do not have transboundary effects in New York State water. This is due to the prevailing flow regime around Cornwall and St. Regis Islands. They do, however, impact on the Quebec waters of Lake St. Francis. Similarly, inputs from Massena, New York, impact Canadian waters in Lake St. Francis.

Identification of Massena sources (ALCOA, Reynolds, General Motors and contaminated sediments in the St. Lawrence River in front of General Motors) as the largest contributor of PCBs to the international section of the St. Lawrence River is well documented.

Transboundary movement of PCBs from Massena sources into Quebec and Ontario is also substantiated by the data. Results from 1988 field studies will provide more specific evidence, however, there

is no program currently in place designed solely to measure transboundary movement.

Phase I of the Public Involvement Program was completed in September 1988. This included an open house in June 1988, the creations of a RAP display and slide show, dissemination of a brochure, fact sheets, draft terms of reference for a Public Advisory Committee (PAC), and presentations by RAP Team members to potential PAC members. A PAC was formed in November 1988 which includes Environment Quebec and the Mohawk people of Akwesasne.

The goal of a joint RAP development process with New York State was partially achieved in May 1988 with an agreement between the Department of Environment, Environment Ontario and the New York State Department of Environmental Conservation to develop a joint statement on environmental problem for the Cornwall-Massena Area of Concern. Two subsequent meetings between the Canadian and American RAP Teams have outlined a process for the development of this joint statement which involves Environment Quebec, the Mohawk people of Akwesasne, and the Canadian and American publics.

## **II. Lakewide Management Plans**

Annex 2 of the Great Lakes Water Quality Agreement commits the Parties to develop and implement systematic, ecosystem based lakewide strategies for restoring and protecting beneficial uses of open lake waters. The Parties, in compliance with Annex 2, are required to undertake the following activities with respect to Lakewide Management Plans:

- (i) **designate Critical Pollutants for the boundary waters of the Great Lakes System or a portion thereof;**
- (ii) **design the Plans to reduce loadings of Critical Pollutants in order to restore beneficial uses;**
- (iii) **classify efforts to reduce Critical Pollutants by their stages of elimination as outlined in the Annex;**
- (iv) **submit the Plans to the International Joint Commission for review and comment at the four agreed stages; and**
- (v) **submit progress reports to the International Joint Commission biennially, beginning in December, 1988.**

The Draft Lake Ontario Toxics Management Plan (LOTMP) follows the General Principles of Annex 2, incorporates Critical Pollutants and tracks the designated reporting schedule. The focus of the Plan, however, is on those who use impairments attributable to toxic chemical contamination. The final Lake Ontario Toxics Management Plan is scheduled for release in December, 1988.

The Lake Ontario Toxics Management Plan was developed by the environmental agencies of the four major government jurisdictions around the Lake Ontario Basin under the Declaration of Intent signed in February 1986. These are the two federal environmental agencies, the Province of Ontario and the State of New York. The Plan:

- sets out goals and objectives for Lake Ontario water quality restoration;
- describes the physical and demographic characteristics of the Lake Ontario Basin;
- defines the present state of knowledge of the Lake Ontario Basin with respect to toxic chemical contamination;
- reviews known and suspected sources of toxic chemical inputs to Lake Ontario and attempts to construct a "loadings matrix";
- describes programs carried out by the jurisdictions to regulate toxic discharge to Lake Ontario and to restore ecosystem integrity; and
- sets out the key elements of a comprehensive, systematic multi-agency approach to fulfilling the stated goals and objectives.

Building on the premise that the focus of a lakewide management plan is the reduction of loadings of Critical Pollutants to the system, the Lake Ontario Plan has four elements:

1. A scheme for classifying chemicals and associated responses, ie. identification of Critical Pollutants;
2. A procedure for assessing the sources, fate and transport of chemicals, ie. modelling their behaviour in the lake ecosystem to facilitate predictions and prioritize actions;
3. Establishment of uniform criteria and standards for permissible concentrations of substances in various media between the participating agencies, and
4. Development and implementation of ecosystem objectives as the measure of whole lake restoration of aquatic integrity.

The four agencies have established committees to address chemical categorization, fate/modelling of toxic chemicals, standards and criteria, and ecosystem objective development. Work under the Plan is closely coordinated with the Niagara River Toxics Management Plan (NRTMP), the RAPs for the Lake Ontario Basin and other Great Lakes water quality activities.

Canada and the United States have agreed to conduct a workshop to consider the development of Lakewide Management Plans for the other Lakes. It will be held in April 1989.

# Annex 3

## Control of Phosphorus

The purpose of Annex 3 is to minimize eutrophication problems and to prevent degradation with regard to phosphorus in the boundary water of the Great Lakes System. **The Parties, in accordance with Annex 3 and its Supplement, are required to undertake the following, in cooperation with State and Provincial Governments:**

- (i) **develop and implement programs to reduce input of phosphorus to the Great Lakes;**
- (ii) **establish load allocations and compliance schedules;**
- (iii) **develop and implement phosphorus load reduction plans;**
- (iv) **develop and implement the following phosphorus control programs:**
  - a. **Municipal Waste Treatment Facilities,**
  - b. **Detergent Phosphorus Limitation,**
  - c. **Industrial Discharges,**
  - d. **Nonpoint Source Programs and Measures,**
  - e. **Research, and**
  - f. **Surveillance and Monitoring.**

In 1985, under the auspices of the Canada-Ontario Agreement Respecting Great Lakes Water Quality, the Non-Point Source Committee (formerly the Environmental Monitoring and Modelling Committee) was established to monitor the progress of programs and activities under Annex 3 and its Supplement. Agriculture Canada, Environment Canada, the Ontario Ministry of Agriculture and Food, and the Ontario Ministry of the Environment are represented on the Committee which is co-chaired by the two environmental agencies.

The Supplement to Annex 3 states that programs be put in place to achieve specified target loads to the Lakes as follows:

**Table II**  
**Phosphorus Load Reduction Targets**  
**(metric tonnes per year)**

Basin	Estimated Loadings* at 1 mg/l (Note 1)	Phosphorus Target Load	Estimates of Further Reductions Required
Lake Erie	13,000	11,000	2,000
Lake Ontario	7,430	7,000	430

\*With all municipal waste treatment facilities greater than one million gallons per day meeting the 1 mg/l Phosphorus objective.

### Phosphorus Load Reduction Plan

In addition to continuing the requirements for phosphorus limitations in detergents, the Canadian Phosphorus Load Reduction Plan requires that lake loadings be limited to the following.

#### Lake Erie:

The load reduction plan for the lake requires the reduction of 300 tonnes per year. This is comprised of 100 tonnes per year from municipal and industrial sources and 200 tonnes per year from agricultural sources.

#### Lake Ontario:

The load reduction plan for Lake Ontario is based on evaluation of lake response to current municipal, industrial and agricultural programs which have evoked a positive reaction by the lake to these measures. This has brought into question whether further reductions, beyond what is required in the Annex, are necessary for Lake Ontario. The outcome depends on a final review, to be made in 1990, of the trophic status of Lake Ontario in relation to the current municipal, industrial and agricultural programs.

#### Upper Great Lakes:

Phosphorus controls for Lakes Superior and Huron are limited to municipal wastewater treatment facilities discharging more than 1 million imperial gallons per day.

The Supplementary Agreement requires that surveillance, monitoring and modelling be conducted to provide improved estimates of loadings and to enable monitoring of progress.

### Municipal Waste Treatment Facilities

Table III summarizes compliance of municipal facilities with phosphorus control requirements for 1986 and 1987. Improved performance is noted, however, further remedial effort is required.

### Phosphorus Detergent Limitations

In June 1988, regulation of phosphorus in detergents was transferred from the Canada Water Act to the Canadian Environmental Protection Act. The Phosphorus Concentration Control Regulation states:

No person shall manufacture for use or sale in Canada, or import any cleaning agent or water conditioner that contains a prescribed nutrient with a concentration that is greater than the prescribed permissible concentration of that nutrient in that cleaning agent or water conditioner.

The new legislation thus considerably broadens the scope of regulatory control of phosphorus in cleaning compounds and water conditioners of all types, and has the potential to result in substantial phosphorus loading reductions throughout the Canadian Great Lakes Basin.

### Industrial Waste Treatment Facilities

The Canadian Phosphorus Load Reduction Plan calls for an aggregate reduction of municipal and industrial loadings to Lake Erie of 100 tonnes per year. Table IV summarizes the industrial loading changes from 1983 to 1987. As anticipated by the Phosphorus Reduction Plan, a major reduction of industrial loading was achieved (103 tonnes/yr) resulting principally from closure of the International Minerals and Chemicals operations at Dunnville.

## Phosphorus Non-Point Sources Programs and Measures

### Rural Non-Point Sources

To implement the program to address agricultural non-point sources for the Lake Erie basin a new agreement, the Canada-Ontario Agreement on Soil and Water Environmental Enhancement Program (SWEEP) was signed in May 1986. It provides funding of \$30 million for implementation during the period 1985-1993. A more complete description of the SWEEP program and other related programs is available in Appendices I and II.

Soil and Water Conservation grants available in the SWEEP area, are also available throughout Ontario to assist farmers with the installation of structural soil erosion control measures and environmentally appropriate animal waste and pesticide handling practices. The erosion control aspect of this program (Ontario Soil Conservation and Environmental Protection Assistance Program, or OSCEPAP) provides grants of two thirds of the cost of structural measures, up to a maximum of \$10,000. Grants of 40 per cent of the cost of manure and pesticide management projects are also available up to a maximum of \$7,500. The OSCEPAP, Tillage 2000 and the Land Stewardship Program are all important initiatives involving financial and other incentives which contribute to reduced loadings of phosphorus.

Cropping and tillage practice changes are expected to account for most of the reductions from agricultural non-point sources. Initial estimates of total phosphorus reductions achieved to date in the Lake Erie Basin through improved livestock waste management practices indicate significant reductions from this source are also possible.

### Urban Non-Point Sources

Urban municipalities are being encouraged to adopt the Urban Drainage Design Guidelines developed by the Province of Ontario through the efforts of provincial ministries and the Conservation Authorities. The model sewer use control further strengthens the effort. Special studies and pollution

**Table III**  
**Compliance with Phosphorus Control Requirements\***

	1986	1987
No. of Plants	103	103
No. in Compliance	46	55
% Compliance	45	53

\*Includes plants with capacities equal to or greater than 1 million imperial gallons per day.

control planning are geared toward developing water quality management plans consistent with both the Supplementary Agreement and efforts to develop Remedial Action Plans for Areas of Concern. Guidelines on Erosion and Sediment Control for Urban Construction Sites are also provided to municipalities.

### Monitoring and Surveillance

Loading data developed from the streamflow monitoring network and the Ontario Provincial Water Quality Monitoring Network are expected to provide the basis for the evaluation of loading trends of phosphorus. Detailed, higher frequency data on sediment phosphorus and other parameters including pesticide and industrial chemical residues are obtained from mouth stations of major tributaries. Together with models, such data increases the accuracy of loading estimates and the ability to detect trends in loading.

### Pilot Watershed Monitoring

The outlets of two of the three pairs of SWEEP Pilot Demonstration watersheds described in Appendix I have been fully instrumented. Loading data from these projects together with upland inventories of land use practices will lead to improved measurements and analysis of phosphorus loadings.

**Table IV**  
**Total Annual Phosphorus Loadings to Lake Erie Basin**  
**from Monitored Industrial Sources**  
**(metric tonnes per year)**

Company	1983	1987
Campbell Soup Company Ltd. St. Mary's	*	1.0
Canadian Industries Ltd. Courtright	6.6	10.6
Ford Motor Company St. Thomas	*	0.9
H.J. Heinz Co. of Canada Ltd. Leamington	3.0	3.6
International Minerals & Chemical Corp. Dunnville	107.7	1.0**
J.M. Schneider Inc. Ayr	0.9	0.3
Omstead Foods Ltd. Wheatley	1.5	1.1
Stelco Inc., Lake Erie Works Nanticoke	1.4	2.4
Tend-R.-Fresh Poultry Ltd. Nanticoke	3.3	0.5
Novacor Chemicals Ltd. (formerly Union Carbide Canada Ltd.) Corunna	0.5	0.3
Total	124.9	21.7

\*Data not available.

\*\*Treated lagoon runoff only.



# Annex 4

## Discharges of Oil and Hazardous Polluting Substances

According to the General Principles of Annex 4 of the Great Lakes Water Quality Agreement, compatible regulations, in Canada and the United States, are to be adopted for the prevention of discharges into the Great Lakes System of harmful quantities of oil and hazardous polluting substances. **Canada has successfully adopted regulations and programs in accordance with the following specific requirements of Annex 4:**

- (i) **prevention of discharges of harmful quantities of oil;**
- (ii) **prevention of discharges of harmful quantities of hazardous polluting substances carried as cargo; and**
- (iii) **provision of adequate facilities for the reception, treatment, and subsequent disposal of oil and hazardous polluting substances wastes from all sources.**

During 1987, the Canadian Coast Guard received a total of 191 pollution reports attributed to shipping and non-shipping sources on the Great Lakes. This compares with a total of 276 in 1986. None of the reported discharges were considered to be major.

The Canadian Ship Safety Branch carried out enforcement investigations in 20 oil pollution incidents that were reported as originating from shipping sources. These investigations resulted in charges being laid against three ships which, in turn, led to convictions and fines. Other reported incidents, not involving ships, and not reported by the Environment Ontario Spills Action Centre were referred to the appropriate provincial authorities.

The introduction of exotic species to the Great Lakes from ballast water of ships has become a concern. One proposal for the monitoring of ballast water is to demand that ballast water be exchanged at sea prior to entering the Great Lakes System. This proposal was presented at the July 1988 Meeting of the Canadian and United States Coast Guards. Subsequently, the issue was raised by the Canadian delegation to the Marine Environment Protection Committee of the International Maritime Organization (IMO).

In addition, the International Chamber of Shipmasters Association was asked to encourage ships visiting Canadian inland ports to exchange their ballast water at sea.

The Shipping Federation of Canada has issued a circular to its members advising them of the ballast water situation and requesting support in resolving the situation. As well, the St. Lawrence Seaway Authority will ensure, by checking logbooks, that vessels visiting the Lakes have met ballast water guidelines.





# Annex 5

## Discharges of Vessel Wastes

Provisions are made in the Agreement to control the discharge of garbage, sewage and waste water from vessels into the Great Lakes System. **In accordance with the following requirements of Annex 5, the Federal and Provincial Governments continue to implement regulations and programs to control the discharge of vessel wastes:**

- (i) designate critical use areas where the discharge of waste water or sewage shall be limited or prohibited;
- (ii) establish regulations to control the discharge of sewage from pleasure craft or other classes of vessels operating in the Great Lakes System; and
- (iii) ensure the provision of adequate facilities for the reception, treatment and subsequent disposal of garbage, waste water and sewage from all vessels.

### Wastewater or Sewage from Vessels

Domestic sewage regulations for ships were developed by Canada and the United States in the 1970s and have been operative for many years. In addition, many countries with ships undertaking voyages to the Great Lakes ports have fitted sewage treatment plants that satisfy the International Maritime Organization (IMO) performance and test standards.

As stated in the Canadian and United States Coast Guards Joint Reports, the Canadian Coast Guard has processed an amendment to the Great Lakes Sewage Pollution Prevention Regulations which will permit periodic test sampling of effluent from marine sanitation devices as an alternative to a monitor on such devices. This amendment has been delayed due to a Regulatory Processing backlog, but should come into force in 1989. Following promulgation of the amendment, foreign vessels fitted with IMO approved marine sanitation devices and United States vessels equipped with United States Coast Guard certified units, will be obliged to produce proof of satisfactory operation of the marine sanitation device before entry into Canadian Great Lakes ports.

Federal regulations for the control of sewage pollution from pleasure craft should come into force in 1989 as well. These proposed regulations are national

in scope and will apply to all internal waters of Canada, to the extent that such water bodies are designated by provincial authority.

The Province of Ontario, alone among Canadian provinces, administers pleasure craft sewage pollution regulations. The federal regulations, which are similar in content to the requirements of the Ontario regulations, will permit provinces to designate water bodies, for application of federal pleasure craft sewage controls, where suitable pump-out facilities are provided. Under the proposed federal regulations and the existing Ontario regulations, houseboats are considered to be pleasure craft and require holding tanks, unless permanently connected to a municipal sewage system.

### Sewage from Pleasure Craft and Marinas

The Ontario enforcement record for the 1987 season for boating and marina inspections is as follows:

Boats	Inspections	752
	Violations	110
Marinas	Inspections	270
	Violations	0

Investigations of several infractions were made and the laying of a number of charges is under consideration by the Province of Ontario.

A study of grey water discharges from pleasure craft is being completed and a report is due late in 1988.



# Annex 6

## Review of Pollution from Shipping Sources

The Canadian Coast Guard, in cooperation with the United States Coast Guard, is continuing to review all aspects of shipping activities for the purpose of maintaining and improving Great Lakes Water Quality. **Specifically, the Parties are undertaking the following:**

- (i) **review services, systems, programs, recommendations, standards, and regulations relating to shipping activities for the purpose of maintaining or improving Great Lakes water quality;**
- (ii) **meet at least once annually to consider Annexes 4, 5, 6, 8, and 9 of the Agreement; and**
- (iii) **undertake studies to establish improved procedures for the abatement and control of pollution from shipping sources.**

In compliance with the intent of Annex 6 of the Amended Agreement, the Canadian Coast Guard and the United States Coast Guard have reviewed progress reports concerning various activities and ongoing studies that have a bearing on the attainment of the overall objectives of the Agreement. These reviews will continue to take place at the Annual Joint Meeting of the Coast Guards.

### Review of the Use of Organotin Compounds

The widespread use of organotin compounds for marine bottom paint application is seen by the Department of Fisheries and Oceans and Environment Canada as posing an environmental hazard to the waters of the Great Lakes. This hazard is particularly prevalent in areas of high boat traffic and low flushing and dilution rates. The more toxic tributyltins (TBT) used on boat hulls and marine and aquaculture facilities is known to be one of the most acutely toxic chemicals to aquatic organisms ever deliberately introduced into water. In Canada, the authority to regulate TBT rests with the Department of Fisheries and Oceans and Environment Canada. They are strengthening their policies regarding these substances. A series of options have been proposed to restrict the use of TBT compounds through the domestic and international regulatory requirements.

### Review of the International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978 (MARPOL 73/78)

Legislation enabling Canadian accession to MARPOL 73/78 has now been passed and accession should occur in 1989. Draft Canadian regulations to implement compulsory Annexes of I and II of the Convention have been prepared. These regulations will not apply MARPOL to Canadian and American ships which are engaged exclusively on voyages in internal waters. Discharge provisions, applicable to the Canadian waters of the Great Lakes, will follow the zero discharge philosophy of the Amended Great Lakes Water Quality Agreement which is more demanding than the discharge provisions.

# Annex 7

## Dredging

Dredging activities under the Agreement are primarily the responsibility of the International Joint Commission's Great Lakes Water Quality Board.

**In accordance with Annex 7, and in cooperation with the Water Quality Board, the following activities are required:**

- (i) **review of existing practices relating to dredging activities, maintain a register of significant dredging projects, and encourage the exchange of information relating to developments of dredging technology and environmental research;**
- (ii) **identification of specific criteria for the classification of polluted sediments of designated areas of intensive and continuing dredging activities within the Great Lakes System; and**
- (iii) **direct attention to the identification and preservation of significant wetland areas in the Great Lakes Basin Ecosystem which are threatened by dredging and disposal activities; and**
- (iv) **encouragement of research to investigate advances in dredging technology and the pathways, fate and effects of nutrients and contaminants of dredged materials.**

Some of these activities are addressed under Annexes 13 and 14 of this Report. The preservation of wetlands is considered in relation to pollution from dredging activities under Annex 13. Pollution from contaminated sediment is addressed under Annex 14.

While there are no specific reporting requirements under Annex 7 there is progress to be cited.

Firstly, existing dredging practices are being reviewed with the intent of developing guidelines and criteria for these activities in the boundary waters of the Great Lakes. Criteria and procedures for open water disposal of dredged material have been drafted and will be reviewed by Canada and Ontario. By agreement with United States agencies, information and developments respecting technology are being exchanged. This is expected to lead to the development of compatible criteria for dredging activities.

Secondly, the Dredging Register is being updated by Canada and the United States. Maintenance of the Register is primarily the responsibility of federal Department of Public Works in cooperation with the Ministry of Transport and Department of Fisheries and Oceans.

Thirdly, meetings and workshops are planned to exchange information and technology developments relating to dredging technology and environmental research.

The identification of specific criteria for the classification of polluted sediments in designated areas of intensive and continuing dredging is being undertaken by Ontario Ministry of the Environment. Revision of the Ministry's Open Water Disposal Guidelines and exchange of information between the Canada-Ontario Polluted Sediments Committee and the United States Environmental Protection Agency is proceeding.

Canada and Ontario will encourage research into advances in dredging technology and will undertake to maintain the Dredging Register in the future.



# Annex 8

## Discharges from Onshore and Offshore Facilities

The control and regulation of onshore and offshore facilities incorporates a wide variety of facilities including land transportation, pipelines on land and submerged under water, offshore drilling rigs and wells, storage facilities and wharves and terminals used for handling oil and hazardous polluting substances. **Annex 8 requires that regulations be adopted for the prevention of discharges of oil and hazardous polluting substances in accordance with the following principles:**

- (i) discharges of harmful quantities of oil or hazardous polluting substances shall be prohibited and made subject to appropriate penalties; and
- (ii) as soon as any person in charge has knowledge of any discharge of harmful quantities of oil or hazardous polluting substances, immediate notice of such discharge shall be given to the appropriate agency in the jurisdiction where the discharge occurs.

Spills and incidents of oils and other hazardous polluting substances are reported to the National Environmental Emergency Service (Environment Canada), the Canadian Coast Guard (Transport Canada) and the Ontario Spills Action Centre (Ministry of the Environment). Records for 1987 and 1988 were available from the Canadian Coast Guard (CCG) and the Spills Action Centre (SAC). Of these two data bases SAC has the most comprehensive summary of spills into the Great Lakes system. During 1987, the Centre received reports on 5,810 spills, 3,990 complaints and handled an estimated 18,000 inquiries. Enforcement measures undertaken by the Province since 1985-1986 are described in Annex 12 in relation to compliance and enforcement. The following tables list direct and indirect spills to the Great Lakes for 1987 (Tables V and VI).

**Table V**  
Direct Spills to the Great Lakes and Interconnecting Channels

Material Groups	Total Number	Quantity (gal)	Median Quantity	Number Unknown Quantity
Oils	214	1-2500	20	105
Chemicals	84	1-37800	200	27
Wastes	167	20-588000	3630	101
Others & Unknowns	45	5-34000	50	32
Totals	510			265

**Table VI**  
Spills to Surface Waters in the Great Lakes Watershed

Material Groups	Total Number	Quantity (gal)	Median Quantity	Number Unknown Quantity
Oils	258	1-90000	20	157
Chemicals	75	1-4400	100	31
Wastes	173	1-623000	4000	107
Others & Unknowns	69	1-175000	225	55
Totals	575			350

Oil spills comprised the largest percentage, 44 per cent of all discharges recorded in 1987. Of the 472 oil spills examined, quantities were known for 210 (45 per cent) of the incidents. Incidents of waste discharges totalled 340 (31 per cent) of all spills; quantities for 132 of these (39 per cent) were known. The median quantity of waste discharges was higher than the other groups. Fifteen per cent (159) of total spills in 1987 were attributed to chemical discharges; quantities were known for 64 per cent (101) of the incidents. In the "other and unknown" category, the 114 incidents represent 11 per cent of total spills for which quantities were known for 24 per cent of the incidents.

Tabulation of spills in 1987 reported by the Canadian Coast Guard represent a small percentage (less than 18 per cent) of those reported to SAC (Table VII). The data reflects some of the trends found in the SAC summary and indicates that the predominant spill materials were oils. This trend continues into the 1988 data set which is complete to October 1988.

Although these data bases reflect the number of incidents within the Great Lakes System they lack the following information: the source, cause and clean up efficiency of discharges. As well, not all incidents were reported to the CCG.

**Table VII**  
**Spills recorded by the Canadian Coast Guard 1987-1988**

Material Group	1987	1988
Oils	121	78
Chemicals	32	23
Wastes	9	6
Others & Unknowns	27	18
Total	189	125

# Annex 9

## Joint Contingency Plan

The Joint Canada-United States Marine Pollution Contingency Plan was adopted in June 1974. The 1987 Protocol requires the maintenance of a Great Lakes Annex to the Plan (CANUSLAK) for use in the event of a discharge, or the imminent threat of a discharge of a harmful quantity of oil or hazardous polluting substances. The purpose of CANUSLAK is to provide for coordinated and integrated response to pollution incidents in the Great Lakes System by responsible federal, state, provincial and local agencies. **With this in mind, the objectives of Annex 9 are:**

- (i) **to develop appropriate preparedness measures and effective systems for discovery and reporting the existence of a pollution incident within the area covered by the Plan;**
- (ii) **to institute prompt measures to restrict the further spread of the pollutant; and**
- (iii) **to provide adequate cleanup response to pollution incidents.**

### Summary of Activities Under the Plan

The Emergencies Branch of the Canadian Coast Guard has produced four detailed response plans; one each for marine spills of benzene, xylene, toluene and styrene. These have been circulated to industry and other government departments for review and comment.

Work is continuing on policy, occupational health and safety, response strategies and training in relation to hazardous materials. As part of this project a consulting firm has been hired to produce a risk analysis and countermeasures study.

In 1987 two co-operative activities were implemented to supplement the CANUSLAK Plan for Lake Erie. Firstly, boom trials were undertaken by a combined Canadian group consisting of Canadian Coast Guard, Environment Canada and the Petroleum Association for Conservation of the Environment. Secondly, overflights and videotapes of the shoreline were made by Canadian Coast Guard and Environment Canada leading to the production of the Lake Erie Sensitivity Atlas.

Further, a major community-oriented exercise took place in Goderich, Ontario resulting in the training of 68 participants in basic marine oil spill response techniques.

### Province of Ontario Spill Action Centre

Established in late 1985, Environment Ontario's Spills Action Centre (SAC) receives notification of spills 24 hours per day, 365 days per year on a province-wide basis using a toll-free telephone number. The centre also handles urgent complaints or inquiries on environmental matters, acting as an off-hour liaison between the Ministry of the Environment, industry and the general public.

The Centre also functions as:

- a communications link with other involved agencies, ie. police, fire department, Coast Guard, United States authorities, etc.;
- a repository for technical information pertaining to spills and other environmental concerns;
- a direct contact with the Ministry in the case of a serious spill or disaster;
- a data base of spills reported to the Ministry.





# Annex 10

## Hazardous Polluting Substances

Hazardous polluting substances include those elements and compounds which, if discharged in any quantity, would present an imminent and substantial danger to public health or welfare. In an effort to control these substances Annex 10 calls for the development and implementation of programs and measures to minimize or eliminate the risk of release of hazardous polluting substances to the Great Lakes System. **As well, Annex 10 calls for the maintenance of the following two lists of substances:**

- (i) **based on documented toxicological and discharge potential data, hazardous polluting substances will be listed in Appendix 1, and**
- (ii) **Appendix 2 will be compiled for potential hazardous polluting substances.**

The original intent of Annex 10 has, to a large extent, been met by Canada through the promulgation of the Transportation of Dangerous Goods Act, the Canadian Environmental Protection Act and Province of Ontario legislation. As well, the intent has been met internationally through an International Maritime Organization (IMO) convention and hazardous polluting substances legislation in the United States. These efforts have also led to the development of new lists of hazardous polluting substances which are continually being updated. Consequently, the lists in Annex 10 are being superseded through these new mechanisms.

In light of these legislative changes, the Parties have determined that a review of Annex 10 is necessary. Upon completion of that review the Parties will make recommendations as to the future of Annex 10.



# Annex 11

## Surveillance and Monitoring

The surveillance and monitoring program in Canada provides the necessary information to assess the states of the lakes. **Under the requirements of Annex 11, surveillance and monitoring activities are undertaken for the following purposes:**

- (i) to measure compliance with jurisdictional control requirements;
- (ii) to measure achievement of General and Specific Objectives of the Agreement;
- (iii) the evaluation of water quality trends;
- (iv) the identification of emerging problems; and
- (v) to support Annex 2 programs (Remedial Action Plans and development of Lakewide Management Plans).

The Parties are required to develop a joint surveillance and monitoring program to ensure attainment of the above purposes modelled after the Great Lakes International Surveillance Plan (GLISP) of 1975 and subsequent modifications. The program components provide for assessment of the following:

- (a) inputs from tributaries, point source discharges, atmosphere, and connecting channels;
- (b) whole lake data including nearshore areas (such as harbours and embayments, general shoreline and Cladophora growth areas), open water of the lakes, fish contaminants, and wildlife contaminants, and
- (c) outflows including connecting channels, water intakes and outlets.

Other requirements include measurement of total loadings of pollutants discharged to and released from the lakes, examining the adequacy of load reductions and schedules contained in Lakewide Management Plans, and the contributions of various media to human exposure to contaminants. Also included is the development of ecosystem health indicators for the Great Lakes.

Monitoring the overall health of the Great Lakes aquatic ecosystem is a major function of the Canada-Ontario Agreement Respecting Great Lakes Water Quality. Under the surveillance program, areas of water quality degradation are investigated and evaluations conducted on the impact of contaminants of the Great Lakes aquatic ecosystem. The program measures the effectiveness of clean-up efforts, warns of emerging problems and tracks down sources of contamination. The program is responsive to the framework of the Great Lakes International

Surveillance Plan (GLISP) developed by the Water Quality Board of the International Joint Commission.

Under COA, "nearshore" surveillance activities, including monitoring discharges from point sources and tributaries, urban and agricultural drainage and impacts of shore-based construction activities are conducted by the Ontario Ministry of the Environment. The Ontario Ministry of Natural Resources assesses impacts of aquatic environmental quality on fish and fish habitat.

Open lake studies including those related to eutrophication, and fish and wildlife contaminants are the responsibility of Environment Canada and Fisheries and Oceans Canada.

The Canada-Ontario Surveillance Committee, under the direction of the Board of Review, is responsible for developing and co-ordinating the surveillance and monitoring activities carried out by Canada and Ontario in fulfillment of Canada's commitments to the joint Canada-United States responsibilities under this Annex.

The development of Remedial Action Plans for the 17 Canadian Areas of Concern are co-ordinated through the federal-provincial RAP Steering Committee described in Annex 2. The surveillance requirements of these Plans are co-ordinated through the Surveillance Committee.

The following is a brief overview of both provincial and federal activities relating to the implementation of surveillance and monitoring activities required under Annex 11.

### Provincial Activities

During the last two years, provincial surveillance and monitoring activities have been oriented largely to the Municipal/Industrial Strategy for Abatement (MISA) Program, Remedial Action Plans (RAPs) and the binational Upper Great Lakes Connecting Channels Study (UGLCCS). In addition, the Province conducts shorter term studies to assess the response of natural water systems to controls, as well as to identify emerging problems and the tracking of longer term water quality trends. Table VIII lists the various surveillance and monitoring activities which are being conducted by the Province of Ontario.

Information based on these activities is presented in reports by the Ontario Ministry of Environment, in scientific papers, and at technical conferences (see Appendix III). Pertinent results from these studies are also summarized and submitted to the Water Quality Board of the International Joint Commission (IJC) for inclusion in the Board's Report to the IJC.

The province has also provided support to the IJC through membership on the IJC Water Quality Board, Water Quality Programs Committee, Surveillance Work Group and associated Task Forces.

### **The Municipal/Industrial Strategy for Abatement (MISA) Great Lakes Pilot Site Program**

The Ontario Ministry of the Environment's Municipal/Industrial Strategy for Abatement (MISA) program is being developed to control and reduce the amount of toxic contaminants in all industrial and municipal effluents discharged into surface waters. The program accords with Ontario's commitment to the Great Lakes Water Quality Agreement which calls for the virtual elimination of persistent toxic substances.

In 1985 and 1986, field studies were conducted at five representative pilot sites on the Great Lakes to determine the transport and fate of specific contaminants in the receiving water ecosystem. Efforts during 1987 and 1988 were concentrated on assessing the results of these surveys including the use of modelling and biomonitoring techniques (i.e. the use of aquatic organisms as indicators of impacts on water quality) to determine the need for further restrictions on effluent discharges. For example, the Thunder Bay pilot site study of the extent of impacts on water quality and sediments resulting from the discharges from Great Lakes Forest Products Ltd. will determine whether existing controls require improvement.

Similarly in 1987, surveys of the St. Marys River pilot site included biological monitoring (clams, spottail shiners, caged fish, fish tumor survey), sediment geochemistry, bedload transport and sediment trap studies, in addition to effluent and sediment toxicity work. The project will assess the impact of Algoma Steel Corporation discharges on the river. As well, requirements for control of trace contaminants in the Company's discharges will be updated.

Intensive sampling of the St. Clair River pilot site initiated in 1986 provided an extensive data base for evaluating impacts of industrial discharges from Dow and Polysar. Models and calibrated data sets for assessment of steady and unsteady-state impacts on the food chain will permit criteria for control of HCB and three other organic contaminants to be derived.

Studies of water transport and dispersion were undertaken in the area of the main sewage treatment plant pilot site at Toronto waterfront in 1984, 1986 and 1987. The spatial distribution of contaminants near the plant outfall were studied in detail in 1986 and 1987. Large volume water sampling techniques were used to assess the fate and transport of chemicals. As well, contaminants in suspended sediments at river mouths were examined. Reporting of this work which will guide further pollution control measures is expected to be completed in 1989.

Hydrodynamic and dispersion modelling carried out in the Cornwall Island - St. Regis Island section of the St. Lawrence River in 1987 and 1988 will enable assessment of the fate and transport of contaminants in the aquatic ecosystem.

### **The Remedial Action Plan (RAP) Program**

In support of the development of Remedial Action Plans the province has conducted a number of field studies to update descriptions of environmental conditions, and to identify associated impaired uses and pollution sources in the 17 Canadian Areas of Concern. Progress in developing and implementing Remedial Action Plans has been described under Annex 2.

In 1988, current metering and monitoring of point source discharges and ambient conditions at **Thunder Bay** were undertaken to define the hydrodynamics and flow patterns of the area. This will assist in determining the effectiveness of various remedial options.

A survey of sediments in **Nipigon Bay** in August 1988 will complete the problem definition phase and identify impaired uses.

Extensive water, sediment and waste characterization studies were conducted at **Jackfish Bay** in 1987. This information is required for understanding the cause-effect relationships between the waste discharges of Kimberly-Clark Ltd. and local environmental conditions.

Field work undertaken in 1988 to complete the environmental data base for the **Spanish River** RAP included sediment and benthic surveys, and a study of bioaccumulation of contaminants.

Sampling and physical studies of water movement were conducted in the **Severn Sound** area to assess long term water quality changes resulting from improved sewage treatment and reduced loadings of phosphorus in the area. Previous monitoring has shown limited response to nutrient control with the potential for continuing eutrophication. An overall nutrient budget of nutrients in the Sound will be developed.

At **Collingwood Harbour** sediment stations sampled in 1986 were re-surveyed in 1987, following dredging of the navigation channel. Analyses showed that levels of contamination in the remaining sediments were significantly lower, while in some portions of the harbour, guidelines continued to be exceeded for PCBs, iron, lead, zinc, copper and chromium.

Ambient water quality conditions in the upper and lower **Niagara River** were surveyed for conventional parameters (bacteria, nutrients) in 1988 to update the previous (1982) information to support development of the Niagara River Remedial Action Plan.

Water quality investigations were completed in **Hamilton Harbour** in 1987 to assess the effect of ammonia and phosphorus reductions at the Hamilton sewage treatment plant, and to provide baseline data for assessment of future remedial measures. Currently, the quality and quantity of suspended sediments discharged into the bay from tributaries and municipal and industrial discharges is under further investigation. The impact of active sediment sources compared with historical accumulations must be clarified before recommendations on remedial options for contaminated sediments can be made.

The long-term effects of municipal phosphorus loading reductions in the **Bay of Quinte** relative to sources of phosphorus in sediments is under study. The extent of heavy metal and organic contaminants in the waters, sediment and biota of the Bay is under examination to assist in formulating specific abatement options for trace contaminants.

To describe problems in the Bay related to swimming and other recreational uses, bacteriological surveys during wet and dry weather conditions were undertaken near Trenton, Deseronto and Picton areas in 1987. Generally reduced levels of bacterial contamination were found compared with conditions reported in 1981.

In the Cornwall/Massena area of the **St. Lawrence River**, water, suspended and bottom sediments and biological monitoring were conducted in 1988 to determine the relative significance of contaminant loadings from Lake Ontario in relation to local sources. This information will be useful in the development of additional remedial measures.

#### **Upper Great Lakes Connecting Channels Study**

Under the three-year joint Canada/U.S. Upper Great Lakes Connecting Channels Study (UGLCCS) the province reported on 1985 sediment and benthic surveys conducted in the St. Marys and St. Clair Rivers. Results from the St. Marys River indicated little improvement in the benthic community over

conditions reported in previous surveys in 1968, 1973 and 1983. Analyses of polyaromatic hydrocarbons (PAHs) in caged clams and surficial sediments showed the highest contamination to be related to Algoma Steel (Algoma Slip), with declining levels observed downriver into Lake George.

The findings of surveys undertaken during the UGLCCS project will be referenced in the RAPs for the St. Clair, St. Marys, and Detroit Rivers and will also support development of the MISA program.

#### **Site-Specific Studies**

The province conducts shorter-term studies to assess response to specific controls and to identify emerging problems.

During 1988, the occurrence and sources of organic and bacteriological contaminants in the receiving waters of the **Detroit River** were surveyed to complement earlier point source studies, and to update the status of bacteriological conditions (1975-1984).

Pre-operational surveys of the Detroit River in the vicinity of the Huron Valley sewage treatment plant, located in Michigan, were conducted in 1988.

Water quality and sediment surveys of five **Lake Erie** harbours (ie. Colchester, Port Stanley, Port Burwell, Port Bruce, Sturgeon Creek) were undertaken in 1988 to assess current conditions.

Results of 1987 biomonitoring (clams, leeches) studies in the **Niagara River** at tributary mouths and shore-based discharges are being compared with ongoing trace contaminant monitoring of indigenous species (spottail shiners, Cladophora), and previous study results, to assess the effects of remedial actions.

Preliminary results show that high levels of PCBs, Mirex and dioxins were found on the U.S. side of the river. Dioxins, including TCDD, found in the tissue of clams exposed in cages near the Pettit Flume sewer in North Tonawanda, New York, were observed at levels ten times those found in a 1985 study. Additionally, levels in sediment at that location were almost three times those found in 1985.

Investigation continues on 1986 sampling of bacteriological parameters along the **St. Catharines** waterfront, in the vicinity of Twelve Mile Creek and the Welland Ship Canal, to assess the significance of Klebsiella bacteria from pulp and paper mill discharges in relation to beach closures. A numerical model is under development to determine the circulation patterns and resulting impact of the Welland Canal and Twelve Mile Creek on the St. Catharines waterfront.

### Basin-Wide Support Programs

The province maintains a series of programs designed to monitor metals, industrial organic substances and pesticides in aquatic biota. These programs, using adult fish, juvenile fish and *Cladophora* are designed to serve several purposes including:

- spatial distribution
- temporal trends
- contaminant source identification
- new contaminant identification
- assess effects of mitigative action
- public health protection
- transboundary movement of pollutants
- ecosystem protection.

The largest undertaking is the Sport Fish Contaminant Testing Program. Since the early 1970s, a wide variety of fish have been collected from over 1500 lakes and rivers, including almost 200 locations along the Ontario shores of the Great Lakes. Fish are tested for a wide variety of organic and inorganic contaminants, residue levels are compared to health protection guidelines and, where warranted, consumption advisories are issued for use by the angling public. A full description of the program is contained in the Ministries of Environment and Natural Resources publication "Guide to Eating Ontario Sport Fish" which is published each spring.

Ontario also maintains juvenile fish testing programs in the Great Lakes and selected inland lakes. Residue levels of metals, industrial organics and pesticides are measured in young-of-the-year spottail shiners in the Great Lakes and young perch from inland locations. This program, used to assess spatial distribution of contaminants, temporal trends and contaminant source identification, has some distinct advantages over adult fish testing programs. The exposure period is precisely known (time of hatch to collection) and the fish do not move very far from their place of birth.

The third biological contaminant monitoring tool is *Cladophora*. This attached filamentous algae is collected from selected areas of the Great Lakes and used to assess temporal trends in contaminant levels.

In 1987, juvenile fish, predominantly young-of-the-year spottail shiners, were collected from 39 sites on the Great Lakes for determination of contaminant residues. While the majority of these collections were intended for general contaminant trend assessment in the connecting channels and at selected sites on the Great Lakes, fish were also collected from

11 Areas of Concern. Spottail shiners were collected from 18 Severn Sound and 16 St. Lawrence River sites in support of the RAP program.

In 1988, juvenile fish were collected from 36 sites on the Great Lakes and from seven Areas of Concern to assess contaminant levels. Fish were also collected from nine sites affected by bleached kraft mill effluent for dioxin and furan residue determinations, and from 17 sites in the St. Lawrence River to support the St. Lawrence River RAP program.

Little change was observed in residue levels for PCB's, DDT and chlordane in the 1986 and 1987 spottail shiner collections when compared with those collected in the early 1980's. Although contaminant levels in the recent collections were much lower than those found in the 1970's, 37 per cent of the 1986 and 50 per cent of the 1987 collection sites still had PCB residues in excess of the 100 mg/g guideline for the protection of aquatic life.

Increased mirex accumulations were found in the 1987 spottail collections from Lake Ontario over previous reports. All collections from western Lake Ontario had mirex concentrations in excess of the guideline for protection of aquatic life.

Annual sampling of *Cladophora* continued for trends in contaminant levels at several selected sites in the lower Great Lakes and connecting channels. In 1987, Niagara River sampling was intensified from approximately 10 to 23 sites as part of the biomonitoring study of contaminant sources. In 1988, additional sites from Lake Erie harbours were sampled to assess current conditions.

Measurable levels of a number of organic contaminants were found in 1986 *Cladophora* collections from the U.S. side of the Detroit River at its outflow into Lake Erie. These same contaminants were not detected in the St. Clair River.

Phytoplankton have been analysed in raw (untreated) water samples from several Great Lakes water intakes since 1967. At present, weekly raw water samples are collected from 18 water intakes locations. They provide a useful measure of near-shore water quality. Water quality parameters include phosphorus, nitrogen, silica, conductivity, chloride, chlorophyll and phytoplankton biomass.

Stratified water quality sampling is conducted regularly at 17 major tributaries to estimate annual nutrient and contaminant loadings. Trend analysis of recent (1985-1987) phosphorus levels against 1975-1977 records shows significant phosphorus declines

in Lake Ontario tributaries, but little net change elsewhere. Continuing surveillance is warranted, especially on the lower lakes tributaries as both urban and agricultural land uses continue to intensify while the Phosphorus Reduction Plan is being implemented.

During 1989, a number of long-term sensing sites will be established in critical areas for detailed bio-monitoring of the effects of organic contaminants. "Sensing sites" will serve as monitors with which to gauge levels of contamination of the lake ecosystem as a whole and as a testing ground for potentially useful biomonitoring techniques.

Assessment by the Ontario Ministry of Natural Resources (MNR) of the interrelation of fishery data bases with water quality and community structure to measure whole lake responses to pollution and pollution control has continued. In 1987, MNR conducted studies on critical fish habitats and fishery population assessments in Areas of Concern.

Eight Areas of Concern were surveyed in 1987; Thunder Bay, Nipigon Bay, Severn Sound, St. Clair River, Detroit River, Wheatley Harbour, Hamilton Harbour and Toronto Waterfront. All these areas support fish communities, although some degraded areas exhibited low abundances and diversities. The lower reaches of the Kaministiquia River were the only sites studied which had greatly impoverished fish communities associated with degraded water quality. The St. Clair and Detroit Rivers both possessed diverse and abundant fish communities in spite of degraded environmental conditions. Significant numbers of diseased fish were observed only at the mouth of the Rouge River in the Detroit River. Observations also suggest that the lack of suitable habitat is more limiting to fish communities than other environmental conditions.



**TABLE VIII****Provincial Surveillance and Monitoring Activities in 1988-1989****A. Ontario Ministry of the Environment**

Thunder Bay Environmental Impacts (currents, water quality)

Nipigon Bay Sediment Survey

Jackfish Bay Environmental Survey (water, sediments, biota)

St. Marys River - Algoma Steel Impact

1. Effluent and Related Ambient River Monitoring
2. Sediment Cores and Surficial Sediment Quality
3. Biological Degradation of Organic Chemicals

St. Marys River Modelling - Chemical Fate and Transport

Spanish River Sediment/Benthic Survey

Severn Sound Eutrophication Control and Monitoring

Severn Sound Post-Construction Survey at New Sewage Treatment Plant Discharges

Severn Sound-Georgian Bay Exchange

St. Clair River Environmental (Sediment and Benthos) Monitoring

St. Clair River Dow Chemical Impacts

St. Clair River Dow Chemical Transport Modelling

Detroit River Environmental Investigations (organics, bacteriological parameters)

Detroit River-Huron Valley Water Pollution Control Plan Impact

Lake Erie Harbours Synoptic Surveys

Niagara River Clam Biomonitoring

Niagara River Water Quality Survey

St. Catharines Bacteriological Study

St. Catharines Nearshore Circulation - Twelve Mile Creek and Welland Canal Impacts

Hamilton Harbour Sediment Inputs and Bioassessment

Metro Toronto Waterfront Trace Contaminant Inputs, Combined Sewer Overflows and Storm Sewers

Toronto Main Sewage Treatment Plant Impact Assessment

Toronto Waterfront: Industrial/Municipal Impacts

Toronto Waterfront: Inventory and Assessment of Contaminants Associated with Suspended Particulates

Project Quinte Participation

Bay of Quinte Toxic Contaminants Study

St. Lawrence River Environmental Investigations (water, sediments)

St. Lawrence River Hydraulic Measurements Study

St. Lawrence River Chemical Transport Modelling  
Long-Term Sensing Sites

Nearshore Young-of-the-Year Fish Contaminants Surveillance

Nearshore Cladophora Contaminants Monitoring

Great Lakes Water Intakes Monitoring Program

Enhanced Tributary Monitoring

**B. Ontario Ministry of Natural Resources**

Analysis, Evaluation and Integration of Data Bases

**FEDERAL ACTIVITIES**

During the last two years, federal surveillance and monitoring activities have been directed to fulfilling the requirements of the Great Lakes International Surveillance Plan (GLISP) as well as special initiatives including the Upper Great Lakes Connecting Channel Study and the Niagara River Toxics Management Plan. In addition to the activities of Environment Canada, special research initiatives in support of surveillance have also been conducted by the Department of Fisheries and Oceans. A summary of all federal surveillance and monitoring activities is presented in Table IX.

**A. Environment Canada****Open Lakes Surveillance**

Water samples were taken during cruises on the lakes. One cruise was carried out on Lake Superior, two on Lake Huron and four on Lake Ontario. The samples were subsequently analyzed by the National Water Quality Laboratory to determine if pollutant levels exceeded the objectives stated in the Great Lakes Water Quality Agreement. Analyses particularly focussed on trace organic contaminants to determine baseline levels of these contaminants in the Great Lakes. Several reports and publications have been submitted on the results of these activities (see Appendix IV).

Information from these activities is presented to the Great Lakes Water Quality Board (GLWQB) of the IJC for inclusion in their report to the Commission.

**Atmospheric Loading**

A network of 16 precipitation stations in support of the IJC Great Lakes International Surveillance Plan to

annual variability. This information includes measures of species composition, abundance and production because these parameters measure the basic structure and energy flow through the ecosystem.

The Bioindex Program also serves to collect baseline data that are not part of the core program, improve methodology when necessary and develop a better understanding of the functioning of the Lake Ontario ecosystem. In these areas, the seasonal patterns of bacteria, ciliates and rotifers have been monitored as well as primary productivity and microzooplankton production. Methods of chlorophyll *a* analysis and sampling techniques and production estimates for zooplankton have been evaluated. The relationship of phytoplankton to their physical and nutrient environments has been examined in the spring, summer and autumn using multiple linear regression techniques. Present investigations include the relationships between zooplankton population measures and productivity and alewife population structure and abundance.

#### **Biological Tissue Archive**

The 1978 GLWQA directs that a biological tissue bank be established to permit retrospective analysis of toxic substances. The Great Lakes Laboratory for Fisheries and Aquatic Sciences (GLLFAS) has maintained a biological tissue archive since 1977. The objectives of the GLLFAS Tissue Archive Project are (1) to maintain a Great Lakes fish tissue archive, (2) to define appropriate collection, handling, preservation and storage conditions required for maintaining the integrity of chlorinated hydrocarbon residues for extended periods in a variety of biological tissues, (3) to develop and implement a Tissue Archive Data Base, and, (4) to prepare a catalogue and user guide which would include all pertinent information on archived samples. Studies have been conducted regarding field collection procedures, short and long term frozen storage, sample form, storage containers and fluctuating freezer temperatures. These factors must be studied in order to archive samples for prolonged periods without appreciable changes in levels of contaminants over time.

Archived samples have been used for the retrospective analysis of TCDD, TCDF, DPE, PCB, PCP, PAHs, toxaphene, mirex, photomirex and chlorinated hydrocarbons.

#### **Hamilton Harbour Contaminants Assessment**

Toxic chemicals such as PAHs, phenols, PCBs and ammonia have continued to contaminate water, sediments and biota and present a potential barrier to rehabilitation of the harbour fisheries. While fish species are relatively uncontaminated by "standard"

chemicals (PCBs, pesticides, mercury) and hence are considered "edible", there are still very high levels of PAHs, cadmium, copper, zinc and PCBs in sediments and water. In addition, some fish populations have a very high prevalence of skin and liver tumours relative to similar populations in less polluted areas. These data suggest that fish should be highly contaminated when in fact they are considered edible. This paradox may be the result of eutrophication that generates abundant particles for adsorption and precipitation of chemicals and anoxic conditions in deeper water that restricts the access of fish to contaminated sediments. It is also possible that levels of "exotic" chemicals are quite high but unmeasured in routine programs. Studies were conducted to address the question of accessibility of fish to contaminated sediments in the Harbour.

#### **Alkyl-leads: Occurrence and Pathways**

To test the bioaccumulation and methylation of lead and alkyl-lead compounds in the aquatic environment, several species of fish were collected from two alkyl-lead contaminated sites: Sarnia, St. Clair River and Maitland, St. Lawrence River and one inorganic lead-contaminated site: Kingston, Cataraqui River. Experiments using caged clams (*Elliptio complanata*) were also conducted in areas of alkyl-lead contamination.

Synthesis of alkyl-lead data from 1981 to 1987 has been completed and will be published as a DFO data report. The results show average alkyl-lead levels varied from year to year but have declined steadily since 1981, reflecting improvements in the reduction of alkyl-lead compounds in the effluents.

### **C. Canada-United States Binational Activities**

#### **Niagara River Toxics Management Plan**

In February 1987, the Governments of Canada, Ontario, the United States and New York signed a Declaration of Intent to reduce point and non-point source loadings of persistent toxic substances to the Niagara River by 50 per cent by 1996. Work would be undertaken jointly, in the context of the Niagara River Toxics Management Plan. A joint four party report, on the first data set collected from April 1986 to March 1987 was released in January 1988.

An updated version of the Plan was distributed to the public for comment in October 1988.

Under the Plan, water and suspended sediment samples collected at Niagara-on-the-Lake and Fort Erie were analyzed for a variety of metals and organics. The analyses of the samples provided data

to estimate the loadings of these chemicals to the river and to Lake Ontario.

A new sampling protocol was established at Niagara-on-the-Lake and Fort Erie in April 1987. A new liquid-liquid counter current extractor (GLSE) was used to extract large volumes of centrifuged water (approximately 50 litres) on a continuous basis over a 24 hour period at the two stations. The flow through period of the river (approximately 15 hours) has been taken into account so that samples at Fort Erie are collected 15 hours in advance of those at Niagara-on-the-Lake. All samples are spiked with surrogate spikes so that field and lab extraction recoveries are known.

Samples were analyzed for several groups of chemicals including volatiles (water only), chlorophenols, organochlorine pesticides and PCB's, polynuclear aromatic hydrocarbons, 2,3,7,8-TCDD, phthalates and chlorobenzenes.

A list of persistent toxic chemicals of concern was prepared by the Departments of Environment and Fisheries and Oceans for the Niagara River. This list was used as the preliminary list from which those chemicals as candidates for 50 per cent reduction

by 1996 would be selected. A joint four party selection procedure was developed.

#### Upper Great Lakes Connecting Channels Study (UGLCCS)

Environment Canada established head and mouth water quality monitoring stations for the St. Clair River in 1987. Water and suspended sediment samples were collected at Point Edward and Port Lambton on a bi-weekly interval. The samples were analyzed for a variety of inorganic and organic chemicals. Data were used in preparation of the UGLCC Study Report.

#### Remedial Action Plans (RAPs)

At the request of the Hamilton Harbour Remedial Action Plan Writing Team, a study was undertaken by Environment Canada to estimate the cost of dredging and disposal of contaminated sediment from Hamilton Harbour. The estimated costs were calculated based on mapping of sediment toxicity sediment surveys, and current dredging and disposal practises.

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### TABLE IX

#### Federal Surveillance and Monitoring Activities

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##### A. Environment Canada

Great Lakes Surveillance (Open Lakes)  
Task Force, Working Group and Committee  
Participation and Support  
Identification of Non-Target Organic Compounds  
in Niagara River  
Water and Suspended Sediments  
Long Term Biological Index Monitoring  
St. Clair River Water Quality Monitoring  
Niagara River Water Quality Monitoring  
Precipitation Chemistry Network  
Investigation of the Feasibility of Establishing a  
Water Quality Monitoring Station on the  
St. Lawrence River near the Canada/US and  
Ontario/Quebec Border  
Organics in Precipitation  
Wetland Status in the Lake St. Clair and Detroit  
River Basins  
Recreational Encroachment on Wetlands in the  
St. Lawrence  
Contaminants in Herring Gulls and Other  
Migratory Birds  
Field Support for Implementation of the GLISP  
Quality Assurance/Quality Control  
Data Base Management (Computer and  
Programming)

##### B. Department of Fisheries and Oceans

Great Lakes Contaminants Surveillance  
Biological Tissue Archive  
Hamilton Harbour Rehabilitation - Contaminants  
Assessment  
Tributyltin: Distribution and Fate in Ontario  
Harbours  
Biochemical Indicators of Chemical Effects on Fish  
Fisheries Restoration in Hamilton Harbour and the  
Bay of Quinte  
Longterm Biological Monitoring Program  
- Lake Ontario  
Rapid Toxicity Testing of Contaminants Associated  
with Sediments and Effluents in the Great Lakes  
A Monograph: Dynamics and Physiological Ecology  
of Great Lakes  
Phytoplankton and their Response to Nutrients  
and Contaminants  
Ultra-trace Laboratory  
Benthic Habitat Concerns, Bay of Quinte and  
Eastern Lake Ontario  
Tumors in Hamilton Harbour Brown Bullheads  
Ship Support



# Annex 12

## Persistent Toxic Substances

New provisions under the Protocol combined with provisions of the 1978 Agreement relating to persistent toxic substances are being implemented in order to control and prevent the input of persistent toxic substances to the Great Lakes System.

In accordance with the programs and activities, outlined below, persistent toxic substances will be virtually eliminated in order to protect human health and to ensure the continued health of the Great Lakes Basin Ecosystem:

- (i) development and adoption of the following programs and measures:
  - (a) an inventory of persistent toxic substances including information on identification, quantitative data and recommendations on handling, use and disposition;
  - (b) coordination of air, water and solid waste programs in order to assess the total input of toxic substances to the Great Lakes System, and
  - (c) disposal of hazardous materials to ensure that they are properly transported and disposed of;
- (ii) establishment of monitoring and research programs in support of the Great Lakes International Surveillance Plan;
- (iii) establishment of an early warning system to anticipate future toxic substances problems;
- (iv) establishment of action levels to protect human health;
- (v) intensification of research in the areas of pathways, fate and effects of toxic substances aimed at the protection of human health, fishery resources and wildlife in the Great Lakes Basin Ecosystem, and
- (vi) report to the International Joint Commission biennially, starting December 1988, on the progress in implementing Annex 12.

This section of the Report considers the efforts by Canada and Ontario to encourage the application of the following Principle (Annex 12, item 2 (a)(iii)):

**The reduction in the generation of contaminants, particularly persistent toxic substances, either through the reduction of the total volume or quantity of waste or through the reduction of the toxicity of waste, or both, shall, wherever possible, be encouraged.**

The principle of waste reduction is contained in federal and provincial legislation, policy initiatives and program activities.

## Federal Activities

### Canadian Environmental Protection Act

In June 1988 the Canadian Government promulgated the Canadian Environmental Protection Act. Unlike previous legislation, this Act provides a comprehensive framework for an ecosystem approach to environmental protection. It thus complements the Fisheries Act by strengthening the government's ability to control the release of toxic substances into the environment.

As a first step towards addressing existing problems, a Priority Substances Advisory Panel was established under the Act. This panel considered criteria for the selection of substances and identified fifty substances of concern in Canada for priority assessment and appropriate follow-up actions including the control of their use or release. In developing such controls the federal government will continue to coordinate its activities with other levels of government and the private sector to ensure identification of existing expertise and maximize opportunities for cooperation and support for its initiatives.

Concurrent with the Act, the government also released the Enforcement and Compliance Policy to facilitate compliance and to ensure that the Act is applied in a fair, predictable and consistent way across Canada.

### Control of Municipal and Industrial Discharges

Releases from major single point sources as well as the reduction of industrial wastewater discharges to municipal wastewater plants continues to be of major concern to the federal government. Increasingly, the control of discharges has become

an important strategy in improving environmental quality and in enhancing Great Lakes water quality. Several industry sectors impacting on the Great Lakes increased their compliance with federal statutory requirements.

In 1983, the Ontario refineries, collectively, were in compliance with the requirements of the Petroleum Refinery Effluent Regulations ninety-nine per cent of the time. This compares with a ninety-six per cent compliance rate for 1980. In 1986 and 1987 effluents from plants producing caustic/chlorine by the mercury cell process were in 100 per cent compliance with the Chlor-Alkali Mercury Effluent Regulations.

Mining operations were in 100 per cent compliance with the Metal Mining Liquid Effluent Regulations in 1986. In the pulp and paper industry the discharge of oxygen-consuming matters improved by 37 per cent between 1982 and 1985. A comprehensive sampling and analysis program for dioxins and furans in the vicinity of Canadian pulp mills using chlorine bleaching was initiated in 1988. This is a cooperative program between the pulp and paper industry and the federal and provincial governments. Environment Canada and Ontario Ministry of the Environment completed the UGLCCS survey of point sources; data on toxic effluent discharges are now available for all major point sources in the Upper Great Lakes Connecting Channels. Environment Canada is also conducting surveys to characterize bleached kraft pulp mill effluents for absorbable halogenated organics and volatile compounds in an attempt to build up a data base on bleached kraft pulp mills in the Ontario Great Lakes Basin.

In recognition of the problems which industrial discharges cause to municipal sewer systems, the federal government has been working with the Province of Ontario, the Great Lakes States and the United States Environmental Protection Agency in an IJC project to evaluate current pretreatment programs in the relevant jurisdictions. The evaluation focusses on the contribution such programs make to the achievement of the Great Lakes Water Quality Agreement goals and objectives as well as the jurisdictional requirements.

## Provincial Activities

The Ministry of Environment is giving high priority to the Municipal/Industrial Strategy for Abatement (MISA), the Clean Air Program (CAP), waste management and control of pollution from diffuse urban and rural sources including surveys of and reductions in pesticide use.

## Control of Municipal and Industrial Sources of Pollution

### Municipal/Industrial Strategy for Abatement (MISA)

The goal of MISA is the virtual elimination of toxic contaminants from all industrial and municipal effluents. This goal statement is consistent with the General Principles of Annex 12 which states that "the intent of programs specified in this annex is to virtually eliminate the impact of persistent toxic substances. The program's goal is achieved through a monitoring regulation followed by an effluent limits regulation for each industrial sector and the municipal sector.

The monitoring regulations are aimed at identifying and quantifying contaminants in discharges. The first monitoring regulation for the Petroleum Refining sector came into force in June 1988 under the Ontario Environmental Protection Act. The Monitoring Regulation for the following sectors will be in place by 1989: Organic Chemical Manufacturing, Pulp and Paper, Iron and Steel, Electric Power Generation, Inorganic Chemicals, Metal Casting, Industrial Minerals, and Municipalities.

The principles of monitoring address Annex concerns as follows:

- high frequency monitoring along with flow measurement is designed to calculate accurate loadings of known contaminants of surface water;
- monitoring for a long list of contaminants is designed to characterize effluents against a priority pollutant list to identify presence of known or suspected contaminants; and
- monitoring parameters consist of both conventional pollutants and priority pollutants from Ontario's Environmental Monitoring Priority Pollutants List (EMPPPL) of 179 contaminants. Criteria for inclusion in the list include toxicity to animals and humans, presence in effluents and surface water, and persistence.

In addition, open scans of effluents are carried out to identify other substances which may be present in effluents. These substances when identified, may be added to EMPPPL, if they satisfy inclusion criteria.

Control of dischargers will be based on best available technology economically achievable. This will be established by effluent limits regulations under the Ontario Environmental Protection Act. Limits will be based on control of contaminants identified in the monitoring regulation, and consideration of control technologies and the economics of each sector. Control could consist of treatment prior to

discharge, in-plant reduction and recycling, or changes in processes to use alternate raw materials or process chemicals.

With respect to controlling industrial discharges to sewers the Ontario Ministry of Environment released a discussion paper in September 1988 outlining proposals to reduce industrial contaminants entering surface water through municipal sewer systems.

#### **Clean Air Program (CAP)**

Regulations are being drafted under the Environmental Protection Act to reduce loadings of atmospheric contaminants by imposing limitations on emission sources based on the toxicity of the substances emitted. A system of scoring toxicity, protective of human health and the ecosystem, will determine the degree of emission control to be applied to produce the lowest level of release of these substances. The program will address, among other considerations, the control of toxic substances which may affect the Great Lakes Ecosystem.

#### **Waste Management: Control of Generation, Handling and Disposal of Waste**

Ontario's waste management program is regulated under the Environmental Protection Act. The regulation sets out a chain of responsibility from waste generation through transportation and disposal in controlling liquid industrial and hazardous wastes. A generator register and manifest system is used to track wastes from source to proper disposal at a receiving facility. Receiving facilities are operated under Ministry of Environment Certificates of Approval which identify wastes acceptable for disposal at each site. The system is managed by the province, with follow-up action, including enforcement for any irregularity.

The storage and movement of PCB wastes as well as the siting, operations and emissions from mobile PCB destruction facilities are regulated. This includes facilities for destruction of PCB contaminated mineral oil.

With respect to incentive programs for encouraging waste management, in June 1987 the Ontario Government announced its Comprehensive Funding Program for waste management. This program provides financial assistance to municipalities and the private sector for waste management activities. These activities include treatment and disposal facilities and initiatives under the Municipal 4R's Program (Reduction, Reuse, Recycling and Recovery Program); Household Hazardous Waste Management Program; and an Industrial Waste Management Program.

**Municipal 4R's Program:** For the 4R's Program the following assistance is now available to municipalities and industries:

- a) There will be increased emphasis on the present Municipal Recycling Support Program (MRSP) that provides funds to assist municipalities in initiating recycling programs.
- b) A new program is now available to assist municipalities in establishing facilities for recovering materials from mixed solid waste, or for processing these wastes into useful products such as fuel or compost. The maximum level of funding available for capital facilities is one third of the in-service capital costs. For research, development and demonstration, the level of funding is up to 100 per cent of the projected cost for a specified period necessary to evaluate the proposal.
- c) A new reduction/reuse program has been introduced to assist municipalities, the private sector or others in implementing projects aimed at altering consumer waste-generation and treatment or disposal practices. This program covers home composting, packaging, and new product approaches. Proponents may receive up to 50 per cent of promotional costs and up to 50 per cent of capital costs incurred by municipalities. Development of creative materials, such as educational pamphlets, will be funded up to 100 per cent - to a limit of \$25,000 for a project.

Three further initiatives include:

1. Increased emphasis in Waste Management Master Plans to assist groups of municipalities, in long-range management planning.
2. The new Financial Assistance Program provides assistance to municipalities for developing new facilities, or for expanding existing facilities such as landfills, transfer stations and processing facilities.
3. Increased emphasis in Waste Management Improvement Program to assist in upgrading existing sites, to close sites, and to do investigative studies or provide remedial measures at active sites.

#### **Household Hazardous Waste Management Program**

The Province has established a program of grants to encourage and aid municipalities in setting up special collection methods to deal with hazardous household wastes. The grants are for multi-material collection projects, including waste solvents, paint, medical compounds, pesticides, etc. and are not aimed at any one waste type. In addition, the document "Guide to Implementing Household Hazardous Waste Collections" has been produced by the Ministry as a detailed, step by step technical guide to conducting such programs.

**Industrial Waste Management Program:** A program is now available to provide assistance for industries to take advantage of new opportunities for waste reduction, reuse, recycling and recovery. This new program provides financial and technical assistance to explore beneficial uses of commercial and industrial waste and their reduction. Eligibility criteria for projects or proposals include feasibility studies; reduction, reuse, recycling or recovery of wastes; process or equipment modification or evaluation; demonstration of technology; upgrading existing operations beyond state-of-the-art for a particular industry, and research. Wastes such as corrugated cardboard, rubber, plastics, solvents and CFC's are included in this program.

Eligible costs for each project include capital costs; start-up costs – up to a maximum of 50 per cent; demonstration/evaluation of technology – up to 100 per cent of eligible costs for a defined time period necessary to demonstrate and evaluate the proposal; and research – up to 100 per cent of eligible costs.

**Ontario Waste Management Corporation:** The Corporation has provided a final assessment of its recommendation for a hazardous waste treatment system to be located in West Lincoln Township. The environmental assessment will be examined by the Province of Ontario as to its compliance with the Environmental Assessment Act. The provincial review will be provided for public consideration and a public hearing concerning the proposal will be conducted by an independent hearing board.

#### **Support for Needed Improvements in Sewage Works**

To help address the needed improvements in sewage works, the Province of Ontario enhanced its direct grants program to municipalities for upgrading and expanding sewage treatment facilities. Under the program provincial assistance for municipalities with populations greater than 7500 has been increased from 15 to 33 per cent of the costs involved. Since June 1987, an additional \$87 million has been committed to upgrading municipal sewage treatment.

#### **Compliance and Enforcement**

Municipal and industrial discharges showed some improvement in compliance requirements for pollution control in 1987, compared with compliance in 1986, for plants with capacities greater than one million gallons per day. The specific details concerning municipal and industrial compliance are outlined in Appendix V of this report. With respect

to municipal facilities on the Canadian side of the Great Lakes operational compliance guidelines exist for phosphorus, suspended solids and biochemical oxygen demand. As well, the Ontario Ministry of the Environment has compliance guidelines for industrial facilities.

With respect to enforcement actions related to environmental offences in Ontario, the Ministry initiated 211 prosecutions in the fiscal year ending March 31, 1988, up from 179 cases in 1986-1987 and 86 during the previous year. This represents a two-year increase of 145 per cent. Convictions were obtained in 170 cases during fiscal year 1987-1988, an increase from 138 convictions in 1986-87 and 71 in 1985-1986.

#### **Early Warning System**

The basin-wide monitoring and surveillance programs described in Annex 11 for metals, organic substances and pesticides in aquatic biota are also used to identify new or potential contaminants of interest in the Great Lakes System. As noted previously, these programs use adult and juvenile fish as indicators, as well as Cladophora and other measures of environmental quality in water drawn from intakes at several waterworks systems.



# Annex 13

## Pollution from Non-Point Sources

The programs and measures for abatement and reduction of non-point sources of pollution from land-use activities include efforts to further reduce non-point source inputs of phosphorus, sediments, toxic substances and microbiological contaminants contained in drainage from urban and rural land, including waste disposal sites, in the Great Lakes System. **In accordance with the requirements of Annex 13, the following activities relating to pollution from these sources shall be carried out:**

- (i) **identification of land-based activities contributing to water quality problems;**
- (ii) **development and implementation of watershed management plans;**
- (iii) **identification, preservation and, where necessary, rehabilitation of significant wetland areas that are threatened by urban and agricultural development and waste disposal activities;**
- (iv) **undertaking of appropriate surveillance and survey programs and demonstration projects as outlined in the Annex;**
- (v) **report to the International Joint Commission biennially, beginning in December 1988, on the progress of implementation of Annex 13.**

Under the Canada-Ontario Agreement, the Non-Point Source Committee will develop programs and measures to achieve these requirements. The existing legislative framework and array of government programs in the non-point source area is extensive and continues to evolve in response to numerous federal and provincial initiatives and responsibilities under the Great Lakes Water Quality Agreement. Highlights of activities follow.

### Wetlands and their Preservation

Annex 7 requires that the Parties "direct particular attention to the identification and preservation of significant wetland areas in the Great Lakes Basin Ecosystem which are threatened by dredging and disposal activities." Annex 13 also requires that steps be taken to identify, preserve, and, where necessary, rehabilitate wetlands threatened by waste disposal, and urban and agricultural development. The Non-Point Source Committee will address activities which will have a positive bearing on the wetland aspects of Annex 7.

The issue of wetlands preservation has received considerable attention in recent years. In Ontario, south of the Precambrian Shield, it is estimated that 75 per cent of wetlands have been lost. The intent of the Province is to stem these losses and to take measures to preserve the remaining wetlands on a priority basis. Ontario, with the Ministry of Natural Resources as the lead agency, has developed a six point program on wetlands. The components are:

1. Wetland inventory and evaluation
2. Land-use planning
3. The Conservation Lands Act
4. Wetland securing effort
5. Wetland research
6. Communications strategy.

To date, 1982 individual wetlands have been evaluated using a classification system based on an assessment of biological, social, hydrologic and special features of a wetland. Wetlands are classed on a scale from 1 (highest value) to 7 (lowest value).

The protection of wetlands in Ontario will be done with the support of a new provincial policy being implemented under the authority of the Planning Act. In October, 1988 the Provincial government approved for release a policy document for public review which when finalized will be incorporated into the planning process carried out by municipalities in co-operation with the Government of Ontario. Municipalities are required to have regard for the provincial policy in establishing land use designations in their Official Plans. As a result, wetlands of provincial and regional significance will be recognized in official plans.

The Ministry of Natural Resources has agreements with Ducks Unlimited and Wildlife Habitat Canada under which funding will be available to enable the acquisition of wetlands, particularly wetlands threatened with imminent conversion to other land uses.

In June 1988, the Conservation Lands Act was passed. This Act introduced land tax incentives to owners of wetlands and other heritage lands. Up to 100 per cent tax rebates will be available to landowners of class 1-3 wetlands.

Research on wetlands is assisting government in setting wetland management priorities. A noteworthy example is the recent work to analyze the physical and biological attributes of critical Great Lakes coastal wetlands. Attention is focussed on these wetland habitats under a joint Canada-United States initiative to develop a Classification and Inventory of Great Lakes Aquatic Habitats.

## **Rural Non-Point Sources**

### **Toxic Substances**

For rural areas a key concern is the introduction of pesticides from diffuse sources into surface and groundwater. Contaminated groundwater is addressed in Annex 16 and activities and programs under the two Annexes are mutually supportive.

### **Reduction in Pesticide and Integrated Pest Management**

A comprehensive and integrated pesticide control program is being implemented to minimize the exposure of humans and the natural environment to pesticides, and to further reduce non-point source inputs to the Great Lakes Ecosystem. Principal controls include regulations under the Pest Control Products Act and the Provincial Pesticides Act. These Acts establish pesticides which may be used and regulate the conditions of sale, storage, use and disposal based on classification criteria. The banning of alachlor, in Canada, is an example of the control possible under the legislation.

Supporting these regulations is a licensing and permit system which prevents excessive and indiscriminate pesticide use. It also specifies the type and quantity of pesticide that may be purchased, and sets out the conditions of use.

A committee is currently evaluating options to recycle pesticide containers and to collect unwanted pesticides. The goal will be to mitigate improper disposal and contamination of disposal sites observed in the past.

The Ministry of Agriculture and Food provides cost-shared grants for the construction of facilities such as nurse tanks and back flow prevention devices for chemical sprayers which reduce the risk of accidental discharges of pesticides to surface or groundwater supplies. A 40 per cent grant to a maximum of \$7,500.00 is available to farmers under this program.

Food Systems 2002, a program recently introduced by the Ontario Ministry of Agriculture and Food, has the goal of reducing pesticides applied to land by 50 per cent over a fifteen year period. In combination with sound land management practices

promoted through other programs, it is anticipated that the loading of pesticides to surface run-off will be reduced even further than the 50 per cent reduction target.

Integrated pest management uses cultural, physical and biological controls as well as targeted chemical methods to control pests. Programs are directed toward the entire pest complex – insects, weeds and disease. Under Food Systems 2002 the Ontario Pesticide Education Program will expand to include growers and provide \$800,000 annually toward research on pest management alternatives that will reduce dependency on chemicals.

### **Research**

A considerable amount of research is being undertaken by various agencies to examine the fate and pathways of agricultural chemicals in the environment. One area of particular interest is the impact of conservation tillage on the use and fate of chemicals. Since a major push is underway to promote conservation tillage in Southwestern Ontario, and since the associated practices bring about changes in the amounts and timing of run-off and percolation to groundwater of pesticides, the promotion of such research is strongly indicated.

Research being funded by the Ontario Ministry of the Environment is supportive of the goals of Food Systems 2002. Projects are being conducted to find alternative pesticides for those deemed environmentally hazardous, and to determine hazards associated with pesticides in use.

## **Conventional Pollutants**

### **Pollutant Reduction through Best Management Practices and Soil Conservation**

In addition to addressing toxic substances, Annex 13 requires that measures be taken to further reduce nutrients, sediments and microbiological contaminants in land drainage. Many of the programs introduced under Annex 3 with the goal of reducing non-point phosphorus rely on the implementation of agricultural best management practices. The programs are intended to reduce the loss of sediment in run-off and corresponding losses of sediment-associated nutrients, chemicals and bacteria.

The SWEEP program was developed as a major component of the Canadian Federal/Provincial Phosphorus Reduction Plan. The Land Stewardship Program, introduced in 1987 originated with a concern by the Ontario Ministry of Agriculture and Food that the soil resource base be managed for sustained production over the long term. A description of these programs is contained in Appendices I and II.

Since 1983 expenditures under the Soil and Water Conservation Grants, see Appendix I, have amounted to \$16 million by the Ministry of Agriculture and Food, and approximately \$1 million by the Ministry of Environment. These expenditures have been made for environmental protection under the Ontario Soil Conservation and Environmental Protection Assistance Program (OSCEPAP).

In addition, the funds for 200-day manure storage and for milkhouse waste treatment have been effective in mitigating such practices as spreading of manure on frozen ground and reducing run-off losses from feedlots, manure storages and barn drainage.

The utilization of sludge on foodlands and further guidelines for use of non-sludge wastes are receiving close study.

### **Watershed Studies**

Since 1985, considerable effort has been devoted to the study and remediation of rural and urban beach pollution resulting from rural diffuse sources in Ontario. A number of programs are being carried out in co-operation with Conservation Authorities which have the goal of locating and remedying bacterial pollution sources impacting on rural beaches. Remedial plans are being developed for priority watersheds over a three year time frame. As plans are completed by the Conservation Authorities, additional watershed studies will be implemented under new agreements with other Conservation Authorities.

Areas for which remedial plans are in preparation are Lake Simcoe, Upper Thames River, Upper Grand River, Maitland River, Ausable River, Sauble River, Upper Welland River, Indian River, Upper Humber River and Don River. In these areas, the grants available to farmers under the OSCEPAP program have been promoted by staff of the Conservation Authorities. Demonstration farms have been established to help promote best management principles for livestock and poultry waste management. A notable example is the Ausable River watershed where water quality improvements are being evaluated over three years of study.

## **Urban Non-Point Sources**

### **Toxic Substances and Sewer Use**

The updated model sewer use by-law which was issued in September, 1988 by the Ontario Ministry of the Environment will enable municipalities to require local industries to reduce toxic discharges to sewer systems. The by-law sets stringent discharge limits on metals such as Copper, Cadmium, Nickel

and Zinc; prohibits the discharge of hazardous substances such as PCB's and toxic pesticides and provides improved administrative procedures to control sewer use.

Under the by-law, significant industrial dischargers and best available technology economically achievable industries will be required to develop best management practices (BMP) plans if their sites generate contaminated surface run-off. The purpose of the BMP plan is to prevent any unnecessary discharges and to minimize any unpreventable discharges of contaminated stormwater to storm sewers. The BMP plans will address items such as materials storage, housekeeping practices, preventative maintenance procedures, safety programs, and employee training.

The discussion paper *Controlling Industrial Discharges to Sewers*, released in September, 1988, outlines a program designed to protect water quality by reducing toxic contaminated industrial discharges to the sewer systems. Nearly one-third of the wastewater received by major urban sewage treatment plants is discharged by industry. This industrial effluent contains most of the metal and toxic organic compounds found in sewage. Since municipal sewage treatment plants are not designed to remove toxic pollutants, many of these contaminants pass untreated or partially treated into natural water systems.

Under the program municipalities would have an important role in controlling such releases. Municipalities would be required to conduct industrial inventories, listing all industries discharging to the sewer system and noting the volume and content of their discharges. At present, an estimated 18,600 industries discharge to municipal sewer systems in the province. By controlling indirect discharges at the source, combined sewer overflows and by-passing of considerable loadings of toxics to the Great Lakes system will be addressed.

## **Pollution Control Planning and Infrastructure**

A municipality may apply to the Ministry of the Environment for a grant to undertake a study to develop a water pollution control plan. The purpose of a water pollution control plan study is to develop a plan which will: (a) outline the nature, causes and extent of pollution problems from stormwater discharges, combined sewer overflows and flooding; (b) propose alternative remedial measures, and (c) recommend an implementation program. Such studies are presently being carried out in urban centres such as Toronto and St. Catharines.

The Ministry of the Environment is proposing that a stormwater management strategy be developed to control municipal stormwater discharges and combined sewer overflows. By controlling these urban non-point sources of pollution, bacterial contamination and toxic discharges to the Great Lakes System would be significantly reduced.

Under its 'Lifelines' program, the Ministry of the Environment is working with municipalities to undertake studies and capital works to correct infrastructure problems which are associated with older communities where combined sewers carry domestic and industrial wastes and stormwater. Sewer rehabilitation will minimize the occurrence of toxic contaminated overflows and stormwater by-passing.

### **Future Considerations**

Future program development will consider the following:

- compilation and interpretation of information on land-based activities which contribute to water quality deterioration locally and lake-wide;
- development and implementation of watershed management plans to reduce non-point source pollution, consistent with the objectives and schedules for individual RAPs or lakewide management plans;
- monitoring of programs for identification and protection of significant wetlands throughout the Great Lakes Basin that may be threatened by urban and agricultural development or the disposal of waste;
- promoting and tracking improvements in monitoring, modelling, estimating and identifying origin of non-point source pollutant loadings to the boundary waters, and
- tracking research and demonstration projects aimed at evaluating the cost and effectiveness of remedial program options and criteria for their broader application.

# Annex 14

## Contaminated Sediment

Contaminated sediments are viewed both as a source of and a result of pollution. The Protocol covers all aspects of the contaminated sediments issue in a comprehensive way by detailing specific measures on both sides of the equation. **In accordance with Annex 14, the Parties, with the cooperation of State and Provincial Governments, are required to:**

- (i) **identify the nature and extent of sediment pollution in the Great Lakes System;**
- (ii) **undertake research and studies, including surveillance programs and evaluation of existing technology for the management of contaminated sediment;**
- (iii) **ensure long-term measures are adopted for the management of contaminated sediment, and**
- (iv) **report to the International Joint Commission, biennially, starting in December 1988, on the progress of implementation of Annex 14.**

The Polluted Sediment Committee, established in 1986 under the Canada-Ontario Agreement Respecting Great Lakes Water Quality is currently addressing the requirements of Annex 14. The major products of these activities will be guidance for the formulation of Remedial Action Plans and Lakewide Management Plans.

### Methods for Monitoring the Movement of Contaminants in Relation to Sediments

The following actions will be undertaken:

- development of a standardized assessment procedure for contaminated sediment which incorporates the physical and chemical evaluation of sediments as well as an assessment of biological implications of the associated contaminants
- development of criteria for the assessment of sediments, based on documented concentrations of metals, organic contaminants in sediment and their impact on aquatic macro-invertebrates and fish
- evaluation of options for the management and restoration of contaminated sediments including but not limited to source abatement and sediment treatment technologies

### Research and Studies

An inventory of current practices and advances with regard to the assessment and management of contaminated sediments will be developed jointly with U.S. agencies. Information is available for mapping, assessment and management of contaminated sediments in the Great Lakes. An inventory of all pertinent data on mapping will be compiled in 1988-1989 to identify gaps and deficiencies in the data base. Thereafter, a data collection program will be instituted and coordinated with activities under Annex 11.

With regard to surveillance programs, Canada and Ontario are working with the United States Environmental Protection Agency to develop a contract aimed at evaluating existing methods for quantifying the transfer of contaminants and nutrients to and from bottom sediments. The studies will look at the state-of-the-art methods used to evaluate chemical flux and assess current research. Recommendations will then be made as to future methodologies.

At the present time, guidelines for evaluation of contaminated sediments exist for 30 parameters. Revised guidelines for contaminated sediments will be tested at several RAP sites. Joint reviews of these criteria will be made with the United States EPA to seek compatible criteria for the development of RAPs.

### Long-Term Measures

In order to ensure the adoption of measures for the management of contaminated sediment through the construction and long-term maintenance of disposal facilities, Canada and Ontario are formulating guidelines and procedures for the controlled land placement of dredge material. A report has been completed which evaluates the state of all confined disposal facilities (CDF) on the Canadian side of the Great Lakes.

Ongoing work involves formulation of predictive techniques for the long term integrity of CDF sites prior to dredging and disposal, development of inspection and monitoring programs including post-audits of the effectiveness of remedial measures, and the development of criteria for closure and capping of sites including the identification of optimal vegetative cover to minimize exposure pathways to the ecosystem.

The Ontario Ministry of the Environment, in cooperation with Environment Canada, has developed a policy for the placement of fill material in the nearshore zone. The Polluted Sediments Committee will review the report and make recommendations in relation to implementation of the policy.

# Annex 15

## Airborne Toxic Substances

Research conducted since 1978 has demonstrated that many toxic persistent substances are carried onto the land, are washed or fall directly into the lakes. The lakes serve as a sink for these substances, which ultimately contaminate the ecosystem. Annex 15 of the Protocol calls for the creation of a surveillance network to acquire accurate information on the amount and nature of toxic substances falling out of the atmosphere, as well as the identification and control of emission sources. **In accordance with the requirements of Annex 15, the following activities are being undertaken for the purpose of reducing atmospheric deposition of toxic substances into the Great Lakes Basin Ecosystem:**

- (i) establishment of the Integrated Atmospheric Deposition Network; and
- (ii) conduct research activities to determine pathways, fate and effects of airborne toxic substances;
- (iii) conduct surveillance and monitoring activities in concert with Annexes 11 and 12;
- (iv) development, adoption and implementation of pollution control measures including technologies and alternative products, and
- (v) report to the International Joint Commission, biennially, starting in December 1988, on progress in implementing Annex 15.

The Airborne Toxics Committee, established under the Canada-Ontario Agreement Respecting Great Lakes Water Quality, was formed to address these requirements.

### Integrated Atmospheric Deposition Network

Canada has established three working groups to address components of the Integrated Atmospheric Deposition Network. Working Group I was established to identify contaminants to be monitored. Working Group II was established to recommend on number, location, equipment and stations as well as scheduling. Working Group III was established to recommend on quality assurance, quality control and general data management procedures. These measures will be coordinated with parallel U.S. working groups which are being organized.

### Pollution Control Measures

A pollution control plan, responsive to item 5 of Annex 15, is under development by Canada and Ontario and a joint recommendation on these measures is expected by January 1, 1989.

### Establishment and Coordination of First Canadian Master Station

In support of the 1987 Protocol requirements for research and surveillance and monitoring, the Atmospheric Environment Service (AES) of Environment Canada is currently constructing a Master Station at Point Petre on Lake Ontario. The design of the sampling station deck was completed and construction commenced in August 1988. October 14, 1988 was the starting date for the station. Several of the samplers which will be installed at the station are in readiness at Point Petre and installation of the federal-provincial shared components of the station is proceeding rapidly. The master station, supported by a series of smaller satellite stations, will be coordinated with the province's network for monitoring the quality of air and precipitation in the Great Lakes region.

### Establishment of an Air Toxics Laboratory

Canada, through the Atmospheric Environment Service has agreed to design and establish an Air Toxic Laboratory at its headquarters in Downsview, Ontario. Analyses of air and precipitation samples taken by the Environment Canada component of the Point Petre Master Station will be carried out in this lab. A senior chemist will be appointed to ensure quality assurance and quality control of the laboratory portion of the Annex 15 activities.

Some of the analytical requirements for the Point Petre monitoring will be contracted out and these include sample preparation, total suspended particulate and total organic carbon particulate analyses. In addition, analysis of trace metal samples in precipitation will need to be carried out by other agencies.

## Research Activities

Health and climate issues are being considered with the cooperation of National Health and Welfare. The following is a list of other current and completed research efforts:

### Environment Canada Atmospheric Environment Service

Establishment of a Master Station at Point Petre and support analysis lab (discussed previously).

Establishment of a satellite station at the Centre for Atmospheric Research (CARE) site to monitor the seasonal variation of air concentrations of PCB congeners.

Establishment of an aerosol trace metal network in Eastern Canada with a reference station at the CARE.

Determination of the deposition of trace organic and metal pollutants in the Great Lakes Basin through the use of lichens as biomonitors.

Measurement of the gas and particle phase concentrations of chlorinated organics using the GAP sampler at Point Petre.

Investigation of particle exchange between the atmosphere and a freshwater lake system under a breaking wave regime.

Investigation of the bubble stripping of gases and particles in breaking waves.

LIDAR mapping of the aerial application of pesticides in order to recommend a more environmentally safe application technology.

Modelling atmospheric transport of toxic chemicals to the Great Lakes Basin with particular emphasis on the parameterization of air/sea and air/soil processes.

### Inland Waters Directorate

Operation of a sixteen station network for measuring conventional chemical pollutants (nutrients, major ions, and metals) in wet precipitation (ongoing since 1979).

Effective 1986, four stations were equipped with organic precipitation samplers: Sibley (L. Superior), South Baymouth (L. Huron), Pelee Island (L. Erie), and Wolfe Island (L. Ontario).

Establishment of a sampler at the Canadian Master Station at Point Petre in October, 1988.

Samplers were developed and used *in situ* liquid/liquid extraction to concentrate and preserve samples and are capable of year-round operation.

Samples are analyzed by Environment Canada's National Water Quality Laboratory for a suite of trace organic contaminants including: organochlorine pesticides (BHC's, endosulfanes, DDT's, DDE's, methoxychlor, dieldrins, heptachlor and mirex), PCB's, chlorobenzenes, PAH's.

Operation of the four station organic precipitation network over the last two years has been virtually trouble free with no major disruption to the sampling schedule.

Results from the network are routinely reported to the IJC (see *Appendix B of the Great Lakes Water Quality Board Report*).

### Conservation and Protection

Operation of two organic monitoring stations for organic compounds such as dioxins and furans, PCB's, chlorinated phenols and benzenes.

River Road Environmental Technology Centre is carrying out method development activities related to inhalable particulates, volatile organic compounds and semi-volatiles.

Operation of four sites (in Ontario) to measure inhalable particulates. Collected filters are analyzed for mass, sulphates, nitrates and 40 elements.

Measurement of volatile organic levels in Toronto, Sarnia and Windsor in support of the AES Eulerian model and Environment Canada's oxidant programs.

Characterization of emissions from stationary sources and assessment of their impacts through programs such as the National Incineration Testing Evaluation Program (NITEP).

Development of a toxic chemical emission inventory for Ontario and Eastern North America.

### National Water Research Institute

Construction and testing of a 30 metre long wind/wave research flume to determine the mass transfer coefficients of organic contaminants under a variety of physical (wind, waves, temperature) and chemical conditions.

Collection of samples to determine feasibility of using vegetation and peat as a biomonitor of atmospheric deposition of organochlorine and metal contaminants in the Lake Superior area.

Commencement of the investigation to determine the availability of atmospherically derived organic contaminants in aquatic systems of differing nutrient status in the Kawartha region of Ontario.



### **Ontario Ministry of the Environment**

Development of sampling techniques for atmospheric deposition of toxic organics in the Great Lakes Basin.

Operation of a network of five monitoring stations for air and precipitation levels of various toxic organics in the Great Lakes Basin.

Operation of a network for air and precipitation levels of trace metals and acidic substances in the Great Lakes Basin.

Investigation of the potential effects of air toxics on the terrestrial portion of the Great Lakes ecosystem.

Development of mathematical models for determining environmental pathways for toxic organics, including internal work as well as research at Universities funded by the MOE Research Grants Program.

Development of an emission inventory for toxic organics in North America, and participation in emission testing programs to improve emission estimates.

Establishment of a database for ambient levels of toxic organics in the air in Ontario.

Examination of risk assessment of air toxics.

Regulating the control of sources based on toxicity of emitted air contaminants.



# Annex 16

## Pollution from Contaminated Groundwater

Increasing knowledge of contaminated groundwater entering the lakes has become evident since 1978. The Parties recognize the need to solve this problem systematically by identifying sources of contaminated groundwater, then documenting its extent and specifying controls. **Specifically, the Parties, in cooperation with State and Provincial Governments, shall:**

- (i) identify existing and potential sources of contaminated groundwater affecting the Great Lakes;
- (ii) map the hydrogeological conditions in the vicinity of existing and potential sources of contaminated groundwater;
- (iii) develop a standard approach and agreed procedures for the sampling and analysis of contaminants in groundwater;
- (iv) control sources of contamination of groundwater and the contaminated groundwater itself, when the problem has been identified, and
- (v) report, to the International Joint Commission biennially, starting in December 1988, on progress in implementing Annex 16.

Sources of groundwater contamination have been reported previously for the Great Lakes Basin (IJC 1983, 1985) and for Ontario (Environment Canada 1985, 1986). A generic listing of possible contaminant sources within the basin is given in Table X.

### Current Groundwater Protection Practices

Groundwater contamination studies within the Great Lakes Basin are for the most part very site specific. Present interest is focussed on protection of water supplies, on sources of contamination such as industrial and municipal waste sites and on their compliance with current Ministry of the Environment legislation and regulatory requirements. Cumulative effects on regional groundwater quality and the Great Lakes Ecosystem have not been considered.

With the exception of some groundwater investigations along interconnecting channels such as the St. Clair River at Sarnia and the Niagara River, investigations dealing with regional groundwater flow and regional groundwater quality are not being undertaken at this time. There is a general lack of

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**Table X**  
**Possible Sources of Groundwater Contamination in the Great Lakes Basin**

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<b>1. Waste Storage and Disposal</b>	<b>2. Industrial and Municipal Operations</b>
Landfills and Dumpsites	Storage tanks
- municipal	Pipelines
- industrial	Spills
Liquid Waste Impoundments	Coal tar sites
- sewage lagoons	Road de-icing salts
- industrial	<b>3. Agricultural Activity</b>
Mine Tailings	Fertilizer
Radioactive Wastes	Pesticides
Coal and Coal Ash from Thermal Power Plants	Animal Wastes
Landspreading	Irrigation
- sewage	<b>4. Other Sources</b>
- oil sludges	Uncontrolled flow
PCB Storage Areas	- natural
Septic Systems	- exploration boreholes
Deep Well Injection of Industrial Waste	Domestic wells
Brine Disposal	Urban drainage
	Acid rain deposition
	Atmospheric fallout

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understanding with regard to groundwater systems within the basin and the effects of groundwater discharge on stream flow to the Great Lakes.

It is important to keep the impact of the various contaminant sources in perspective. For example, municipal landfill sites have a very high public profile and their approval is subject to lengthy public hearing and yet chloride loadings from landfills to the Great Lakes may be very minor compared to the amount of chloride generated by the application of road salt, the uncontrolled flow from improperly abandoned exploration boreholes and the natural discharge of bedrock brines.

A preliminary evaluation of the possible groundwater contamination sources listed in Table X has been undertaken. There has been no attempt made to prioritize the various sources since the extent of contamination will depend upon source and site characteristics. This information will be given further consideration.

### Implementation of Annex 16

The first requirement is to identify existing and potential sources of contaminated groundwater within the Great Lakes Basin.

Each year the Province conducts hundreds of hydrogeological investigations, many of which are related to complaints from domestic well owners who have experienced groundwater quality and quantity problems. As well, Canada and Ontario fund detailed hydrogeological studies by the private sector at sites where groundwater contamination problems exist.

Present legislation is generally adequate with respect to groundwater contamination sources, and an inventory of pollution sources is being established. The main concern lies with historical sources which were established prior to legislation, and which only become known when an impact on groundwater quality is discovered. Knowledge about these sources is well documented in cases of waste disposal and coal gasification plants, but largely unknown in cases such as the abandoned oil and gas wells in Southern Ontario.

Some sources are not easily inventoried. For example, septic tanks are too numerous to inventory and would require continual updating. Others such as pesticides have changing source inputs due to the availability of new chemicals, and the practice of crop rotation, which results in the application of different chemicals to different crops rotated on the same field.

Secondly, the mapping of hydrogeological conditions in the vicinity of existing and potential sources of contaminated groundwater is required. Some of these

hydrogeological studies at closed waste and coal gasification plant sites have already been made. Other such studies are undertaken as sites become identified as potential sources of groundwater contamination.

Limited regional hydrogeological studies are being undertaken in the Niagara Falls area, and the former industrial deep well disposal area at Sarnia.

The third requirement of Annex 16, the development of a standard protocol for sampling and analysis of contaminants in groundwater, will be addressed through a joint Canada - United States Working Group.

The fourth requirement is the control of sources of contamination and the contaminated groundwater itself through appropriate remedial action.

### Action Plan

- (i) The Canada-Ontario Groundwater Committee will address groundwater contamination concerns within the Great Lakes Basin according to the terms of Annex 16.
- (ii) The Groundwater Committee with representation from governmental jurisdictions will develop a mutually acceptable approach to sampling and analysis of groundwater contaminants within the Great Lakes Basin.
- (iii) Current programs and projects investigation and remedial projects to address sources of groundwater contamination within the Great Lakes Basin will be continued.
- (iv) Consideration will be given to programs to monitor regional groundwater quality within the Great Lakes Basin to evaluate the contamination of principle aquifers and drinking water supplies.

# Annex 17

## Research and Development

Annex 17 delineates research needs to support the achievement of the goals of the Great Lakes Water Quality Agreement, in accordance with the provisions of Annexes 1, 2, 11, 12, 13, 14, 15 and 16. These include programs and projects to develop and determine the following:

- (a) the mass transfer of pollutants between the Great Lakes Basin Ecosystem components of water, sediments, air, land and biota;
- (b) load reduction models;
- (c) physical and transformational processes affecting the delivery of pollutants by tributaries;
- (d) cause-effect inter-relationships of productivity and ecotoxicity;
- (e) relationship of contaminated sediments on ecosystem health;
- (f) pollutant exchanges between Areas of Concern and the open lakes;
- (g) aquatic effects of varying lake levels in relation to pollution sources;
- (h) ecotoxicity and toxicity effects of pollutants in the development of water quality objectives;
- (i) impact of water quality and the introduction of non-native species on fish and wildlife populations and habitats;
- (j) encourage the development of control technologies;
- (k) action levels for contamination that incorporate multi-media exposures and the interactive effects of chemicals; and
- (l) approaches to population-based studies to determine long-term, low-level effects of toxic substances on human health.

Many projects related to the above have been described under other Annexes of this report. Specific measures of note recently undertaken relate to the research needs of Annex 2. These include a report of Remedial Action Plan (RAP) Research Needs and research requirements for Lakewide Management Plans. The report on RAP research needs was stimulated by a request from the Council of Great Lakes Research Managers. Contributions to this effort were made by the National Water Research Institute, Environment Canada, Department of Fisheries and Oceans, the Ontario Ministry of the

Environment and the RAP Steering Committee and Coordinators. The report is being completed by the International Joint Commission (IJC).

The development of research requirements for the Lake Ontario Toxics Management Plan was supported by both the federal and provincial environment agencies.



# Appendix I

## Soil and Water Environmental Enhancement Program (SWEEP)

As of December 31, 1988, the SWEEP Program will have been in place for two full years. The program undertakes the objectives through a wide array of approaches, is dynamic and well organized and shows the potential to bring about the required phosphorus loading reductions through the promotion of better management of soil and water resources in southwestern Ontario.

The structure of the SWEEP Program is depicted in Figure 1. There are essentially three federal, three provincial and four joint federal-provincial program components. Due to delays in start-up, the federal programs have been extended to run to March 31, 1993 while the provincial programs run to March 31, 1991. A brief description of the SWEEP sub-programs and highlights of their progress follows:

### Sub-Program 1

The purpose of this sub-program is to stimulate adoption of the soil management and cropping practices required to improve water quality and reduce soil erosion and degradation, by assessing technology, by interpreting and communicating information, and by identifying required public policies and programs.

#### (a) Technology Assessment Panel (TAP)

TAP is a panel of farmers, researchers, private consultants and government extension specialists appointed for two and three years whose mandate is to assess the suitability of technological innovations related to soil conservation. As SWEEP progresses, TAP will assess the suitability of soil conserving machinery, tillage practices and cropping methods for southwestern Ontario.

This panel has to date assisted in advising on plans of other sub-programs for the upcoming growing season. The pilot Demonstration Watershed Sub-program and the Technology Evaluation and Development Sub-program have both benefited from formal review of the workplan by TAP. It has also identified and provided a preliminary assessment of soil conservation technology valid for Ontario based on an analysis of results from international, federal, provincial, university and private sector work. Notably, this expert panel reviews all research

reports produced under SWEEP to ensure they are of high calibre.

#### (b) Conservation Information Bureau

The goal of this initiative is to provide a leadership role in interpreting and communicating information on soil and water management Ontario.

A feasibility study for the Centre was completed in 1987. A committee of TAP members and representatives of the University of Guelph are presently developing a proposal to establish a centre in Guelph.

Six research contracts have been awarded funding to date. Three of these were completed in 1987-88 and two are slated for completion in 1988-89. Five new proposals were received seeking funding for work to be done in 1988-89.

### Sub-Program 2

#### (a) Technology Evaluation and Development (TED)

The goal of the TED sub-program is to evaluate, develop and adapt cost-effective technology that will lead to soil conservation and improved water quality. It will consider conservation cropping, tilling and planting and integrated pest management. TED is intended to develop and test technologies that have a high probability of success on commercial farms.

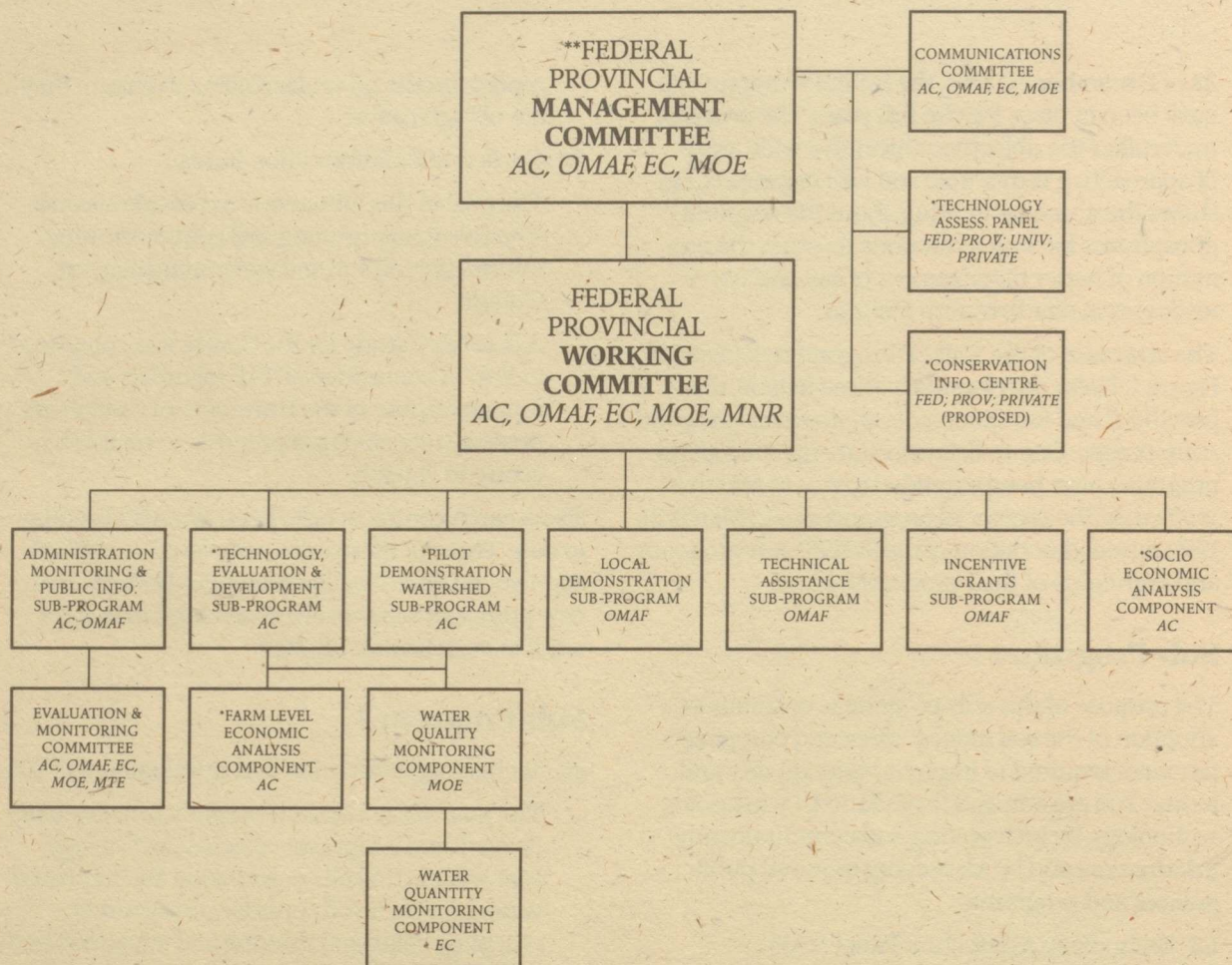
To date two projects have been completed, seven projects are under way and eight new projects have been defined.

#### (b) Farm Level Economic Analysis

This component of the TED sub-program is designed to evaluate the economic impact of newly developed SWEEP technologies and techniques. To be sustainable, soil and water conservation practices must be economically viable. The goal of this sub-program is to establish a data baseline and to develop analytical tools for a realistic economic assessment of conservation practices.

This program component will draw information from the Pilot Demonstration watersheds program (Sub-program 3) and elsewhere. To date, a

# Organizational Chart for the Soil and Water Environmental Enhancement Program (SWEEP).



## Notes

- \*Executed by private contractors.
- \*\*The Management Committee reports to the federal and provincial Ministers of Agriculture and Environment and is the communications link to the Canada/Ontario Agreement on Great Lakes Water Quality.

## Departmental Abbreviations

AC - Agriculture Canada; OMAF - Ontario Ministry of Agriculture and Food; EC - Environment Canada; MOE - Ontario Ministry of Environment; MNR - Ontario Ministry of Natural Resources; MTE - Ontario Ministry of Treasury Economics.



computerized data base for economic data and a rationale for the collection of data has been established, and data acquisition has been initiated.

### **Sub-Program 3: Pilot Watersheds Program**

This sub-program tests the effectiveness of state-of-the-art conservation practices in action on working farms on a watershed scale. The effects of using these practices on all farms in 3 experimental watersheds will be compared with observations in 3 and control watersheds in which conventional practices are maintained. Both treated control watersheds will be evaluated for impacts on water quality, hydrology, soil quality, crop production and economics at the farm scale.

Due to delays in start-up, the pilot watersheds were not selected until the middle of 1988. At the present time, all three pairs of watersheds have been chosen and contractual arrangements finalized with participating landowners and contractors. The Environment agencies have installed watershed outlet quality and quantity monitoring stations with data logging and real-time monitoring capability and have acquired some preliminary run-off data. Detailed soil surveys in the watersheds have also been initiated.

### **Sub-Program 4: Local Demonstrations**

The goal of this sub-program is to promote the wider adoption of proven soil and water conservation technology on agricultural land. The focus will be on soil and crop management practices, primarily tillage and crop rotations. The demonstrations will provide farmers with first-hand information on how to use the practice, its benefits, problems, and the resultant changes in crop yield, soil structure and erosion. The economic aspects of alternative systems will be useful for assisting farmers in making decisions on the selection of a conservation management practice for their farm.

#### **(a) "T-2000"**

The goal of this program is to establish 30-50 on-farm sites for 3-5 years to demonstrate and monitor the effects of alternative tillage practices and crop rotations. The program was initiated in the spring of 1985.

To date, 29 T-2000 sites have been established within the L. Erie basin. Farmer acceptance of the program has been good. The average conservation tillage index (Conservation yield/

conventional yield x 100) for all crops was 99.5 in 1987 and 97.0 in 1986. The sites are being monitored for soil loss rate differences using Cesium 137 soil profile analysis.

#### **(b) Side-by-side Demonstrations**

These projects, on a large number of farms, consist of comparative demonstrations to promote soil and water conservation techniques by working with farmers. To date, 130 conservation tillage demonstrations have been initiated.

A data base on project results has been compiled.

### **Sub-Program 5: Technical Assistance**

The goal of this program is key to the achievement of the non-point phosphorus load reduction target for L. Erie: to assist in instituting the required best management practices on 8,000 farms, covering 400,000 hectares in order to obtain the necessary reduction in soil loss. The program provides farm level conservation advice utilizing a professional team approach with expertise in soils and crops, soil and water engineering, and farm management.

Throughout the 1987 and 1988 growing seasons farmers have shown great interest in adopting existing equipment to plant crops into higher residue levels. Tillage and crop demonstrations have increased from 1987 to 1988, as have programs demonstrating various erosion control structures. Several "fact sheets" have been developed promoting land stewardship, demonstration results and programs.

### **Sub-Program 6: Soil and Water Conservation Incentive Grants**

This is a capital grant program administered by the Ontario Conservation and Environmental Protection Assistance Program (OSCEPAP), intended to assist in the costs of on-farm construction of projects which protect water and soil quality. In most cases, 2/3 of the cost of construction of structural erosion control measures is reimbursed, to a maximum of \$10,000.

Although not considered a part of the SWEEP program, a second part of the OSCEPAP program provides grants for 40% of the cost of farm manure and milkhouse waste management projects to a maximum of \$7,500. In addition, in some watersheds, the Ontario Ministry of the Environment enhances the manure storage grant by increasing the maximum grant available to \$12,500. Several million-dollars have been spent on manure storages with run-off controls in the Lake Erie basin.

### **Sub-Program 7: Administration, Monitoring and Communications**

The goals of this sub-program are (i) to ensure that the entire SWEEP program is implemented on a timely and efficient manner and (ii) to inform the urban and rural farm public of the nature and consequences of soil and water quality problems and of SWEEP objectives.

# Appendix II

## Land Stewardship Program (LSP)

The Ontario Land Stewardship Program of the Ministry of Agriculture and Food is a three year, \$40 million program to provide financial incentives for first-time adoption of conservation farming practices on Ontario farmland.

LSP consists of 4 components:

- |                             |                  |
|-----------------------------|------------------|
| (1) financial assistance    | (\$31.3 million) |
| (2) research                | (\$ 3.3 million) |
| (3) extension/education     | (\$ 2.4 million) |
| (4) County program delivery | (\$ 3.0 million) |

### Financial Assistance

Grant incentives are available under 4 sections of this component.

- (a) **Soil Structure:** Financial assistance is available to encourage **crop rotation**, increase **residue cover**, **tree planting** and incentives for landlords to require tenants to **adapt conservation practices**.
- (b) **Soil Erosion Structures:** A maximum of \$3,000.00 per project is available to encourage good maintenance of open municipal drains; money has also been made available to encourage the use of soil conservation grants under the Ontario Soil Conservation and Environmental Protection Assistance Program.
- (c) **Conservation Equipment:** Farmers can receive grants of 80 per cent to a maximum of \$3,000 per applicant to rent residue management equipment; a further two-thirds grant is available to a maximum of \$3,000 per applicant for modification or purchase of residue management equipment.
- (d) **Technical Training:** Financial assistance is available for **conservation training courses** as well as "on-farm" **instruction**.

### Research

The sum of \$2.3 million has been made available through the Agricultural Research Institute of Ontario for research projects related to stewardship practices. A further \$1.0 million is available for the establishment of a Chair at University of Guelph to promote land stewardship awareness.

### Extension/Education

A total of twelve new staff have been hired to assist an existing fourteen soil conservation advisors in administering the program.

### County Program Delivery

The sum of \$1.0 million is paid annually to the Ontario Soil and Crop Improvement Association to fund local county committees. These Committees receive, review and recommend funding for individual projects.

### Progress of the Land Stewardship Program

All of the funds allocated to this program (\$40 million over three years) have been fully committed. A total of 5110 applicants from the counties within the Lake Erie Basin requested \$38 million for eligible projects. Unfortunately, only \$19 million (50 per cent) of the total \$31 million of direct financial incentives available for the province over the three years could be allocated to this portion of the province.



# Appendix III

## Provincial Publications, Reports and Presentations Relating to Surveillance and Monitoring

### Publications

St. Lawrence River Area of Concern. Draft Remedial Action Plan for the Cornwall Area. COA Report. Anderson, J.A. et al (1987).

St. Lawrence River Environmental Investigations Volume II. Environmental Quality Assessment of the St. Lawrence River in 1985 as Reflected by the Distribution of Benthic Invertebrate Communities. Consultant Report submitted to the Ontario Ministry of the Environment, December 1987, Aquatic Ecostudies Ltd., Kitchener, Ontario (1987).

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Benthic Invertebrate Survey of the St. Marys River, 1985. Volumes I and II. Consultant report submitted to the Ontario Ministry of the Environment, December 1987, Beak Consultants Ltd., Mississauga, Ontario (1988).

The Effect of Contaminants Associated with Suspended Sediment on Water Quality in the Toronto Waterfront During 1985, Ontario Ministry of the Environment report, May 1988. Boyd, D. (1988).

Contaminated Sediments in Areas of Concern, Volume 1: Initial Assessment. COA report, August 1988. Boyd, D. et al (1988).

Survey of Critical Fish Habitat within International Joint Commission Designated Areas of Concern, June-October, 1987. Consultant Report submitted to the Ontario Ministry of Natural Resources, January 1988, Ecocern Inc., Toronto, Ontario (1988).

St. Clair River Sediments. Consultant report submitted to the Ontario Ministry of the Environment, April 1987. Eli Eco Laboratories Inc., Rockwood, Ontario (1987).

Lake Ontario Alewife Impingement Model. Consultant report submitted to the Fish Impingement Technical Committee (funded, in part, by MOE), July 1987, Toronto, Ontario. ESSA Environmental and Social Systems Analysts Ltd., (1987).

Current and Historical Contamination of Sediment in the St. Marys River, 1987. Report submitted to the Upper Great Lakes Connecting Channels Study Activity Integration Committee, April 1987. Hesselberg, R.J. and Y. Hamdy (1987).

Status Report on the Development of the 17 Ontario Remedial Action Plans. Submitted to the International Joint Commission, May 1987.

Aquatic Environment of Humber Bay. Ontario Ministry of the Environment report, (June 1988). M. Griffiths (ed).

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Implementation of Recommendations of the 1986 St. Clair River Pollution Investigation Report. COA report, February 1988. Johnson, G.D., ed. (1988).

Estimated Contaminant Loadings in the St. Clair and Detroit Rivers - 1984. Ontario Ministry of the Environment report, November 1987. Johnson, G.D. and P.B. Kauss (1987).

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# Appendix IV

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# Appendix V

Municipal and industrial discharges showed some improvement in compliance with requirements for pollution control in 1987 compared with compliance in 1986 for plants with capacities greater than one million gallons per day.

## Municipal and Industrial Compliance in the Great Lakes Basin

	1986	1987
<b>Municipal*</b>		
No. of Major Facilities	103	103
No. in Compliance with all requirements	42	53
<b>Industrial</b>		
No. of Major Facilities	134	132
No. in Compliance with all requirements	79	93

\*Municipal facilities with capacities of equal to or greater than 1 million gallons per day.