

# ENVIRONMENTAL MANAGEMENT STRATEGY FOR THE GREAT LAKES SYSTEM

FINAL REPORT TO THE  
INTERNATIONAL  
JOINT COMMISSION

FROM THE  
INTERNATIONAL  
REFERENCE GROUP  
ON GREAT LAKES POLLUTION  
FROM LAND USE ACTIVITIES  
PLUARG

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# SUMMARY AND CONCLUSIONS

## INTRODUCTION

The Canada-United States Agreement on Great Lakes Water Quality signed at Ottawa, April 15, 1972, by the President of the United States and the Prime Minister of Canada, requested the International Joint Commission (IJC) to conduct a study of pollution of the boundary waters of the Great Lakes System from agricultural, forestry and other land use activities. As a result, an intensive inquiry was conducted by the International Reference Group on Great Lakes Pollution from Land Use Activities (PLUARG), established by the IJC.

The scope of this inquiry was broader than previous Great Lakes studies conducted under the sponsorship of the Commission. The entire land area, as well as the water, in the basin was studied. The basin totals 755,200 km<sup>2</sup> (295,000 mi<sup>2</sup>) in area, with 538,900 km<sup>2</sup> (200,000 mi<sup>2</sup>) of land and 216,300 km<sup>2</sup> (95,000 mi<sup>2</sup>) of water surface area. The Great Lakes contain approximately 20 percent of the world's fresh surface water supply. Until recently, the Great Lakes have been viewed as a virtually inexhaustible supply of high quality water. However, increasing population, advancing technology and intensifying water and land use in the basin have caused water pollution.



The Pollution From Land Use Activities Reference Group



The 37 million Canadians and United States citizens living in the basin, the industrial heartland of both nations, generate a major portion of their two countries' gross national products. Although the Great Lakes are an interconnected system, each basin is unique in terms of its limnology, the socio-economic characteristics of its communities, the types and degrees of pollution and the kinds of control measures required.

PLUARG confirmed and studied two major pollution problems in the Great Lakes Basin: eutrophication, due to elevated nutrient inputs, particularly in the lower lakes, Erie and Ontario; and increasing contamination by toxic substances. While the Great Lakes themselves are a focal point of concern and clean-up efforts, it became apparent during the PLUARG studies that they are part of the complex system of the Great Lakes Basin. Future efforts should recognize that the interactions of climate with the land and its use exert a major influence on the Great Lakes.

Past studies ("Report to the International Joint Commission on the Pollution of Lake Erie, Lake Ontario and the International Section of the St. Lawrence River, 1969") indicated that current conditions in the lakes could not be related entirely to pollutant loadings from readily identifiable point sources. These studies indicated that for lakes Erie and Ontario, respectively, 30 and 43 percent of the total phosphorus load was due to sources other than municipal sewage treatment plant and industrial effluents.

In attempting to quantify and describe nonpoint sources of pollution, PLUARG reviewed and studied the pollution potential of several land use activities. These included agriculture, urban, forestry, transportation and waste disposal, as well as natural processes such as lakeshore and riverbank erosion. PLUARG also examined atmospheric deposition of materials on land and water surfaces. Pilot watershed studies were established and monitoring programs initiated to further define the relationship between land use activities and water quality.

Diffuse source pollutants are not derived uniformly from whole watersheds or even sub-basins. Problem areas may represent only a small proportion of a drainage basin area. As a result, PLUARG has developed criteria for the identification of potential contributing areas and within these, the most hydrologically active areas, those zones most likely to produce water pollution from land use activities.

In seeking solutions to most problems of pollution from land use activities, it is important to recognize several things: (1) their long term nature; (2) their ramifications through most sectors of society; (3) the need to involve many agencies in their implementation; and (4) their public consequences in such policy areas as food production, housing and public health.

GREAT LAKES WATER QUALITY POLLUTANTS

I. PARAMETERS FOR WHICH A GREAT LAKES WATER QUALITY PROBLEM HAS BEEN IDENTIFIED

POLLUTANT	PROBLEM		SOURCES				REMARKS
	Lake-wide	Nearshore or Localized	Land Runoff	DIFFUSE Atmosphere	In-Lake Sediments	POINT	
Phosphorus <sup>1</sup>	Yes	Yes	Yes	Yes	Yes <sup>a</sup>	Yes	<sup>a</sup> percentage unknown; not considered significant over annual cycle
Sediment <sup>b,1</sup>	No	Yes	Yes <sup>c</sup>	Negligible	Under some Conditions	Negligible	<sup>b</sup> may contribute to problems other than water quality (e.g., harbor dredging) including streambank erosion
Bacteria of Public Health Concern	No	Yes	Minor <sup>d</sup>	No	No	Yes	<sup>d</sup> land runoff is a potential, but minor source; combined sewer overflows generally more significant
PCBs <sup>1</sup>	Yes	Yes	Yes	Yes	Yes	Yes	
Pesticides <sup>1</sup> (Past)	Yes <sup>e</sup>	Yes <sup>e</sup>	Yes	Yes	Yes	No	<sup>e</sup> some residual problems exist from past practices
Industrial Organics	Yes	Yes	Yes	Yes	Yes	Yes	
Mercury <sup>1</sup>	Yes	Yes	Minor	Yes	Yes	Yes	
Lead <sup>1</sup>	Potential <sup>f</sup>	Potential <sup>f</sup>	Yes	Yes	Yes	Yes	<sup>f</sup> possible methylation to toxic form

II. PARAMETERS FOR WHICH NO GREAT LAKES WATER QUALITY PROBLEM HAS BEEN IDENTIFIED, BUT WHICH MAY BE A PROBLEM IN INLAND SURFACE WATERS OR GROUNDWATERS

Nitrogen	No	No <sup>g</sup>	Yes	Yes	Minor	Yes	<sup>g</sup> some inland groundwater problems
Chloride	No	No <sup>h</sup>	Yes	Negligible	No	Yes	<sup>h</sup> some local problems exist in nearshore areas due to point source
Pesticides <sup>1</sup> (Present)	No	No <sup>i</sup>	Yes	No	No	Yes	<sup>i</sup> new pesticides have been found in the environment; continued monitoring is required
Other Heavy Metals	Potential <sup>f</sup>	Potential <sup>f</sup>	Yes	Yes	Yes	Yes	
Asbestos <sup>j</sup>	No	Yes	No	?	Yes	Yes	<sup>j</sup> see Upper Lakes Reference Group Report
Viruses <sup>k</sup>	No	No	No	No	No	Yes	<sup>k</sup> better detection methods needed
Acid Precipitation	No	No <sup>m</sup>	No	Yes	No	No	<sup>m</sup> a potential problem for smaller, soft water, inland lakes

<sup>1</sup>sediment per se causes local problem; phosphorus and other sediment-associated contaminants have lakewide dispersion.



Population growth and location, industrial development and technological innovation will all have impacts on the loadings of pollutants to the lakes from land use activities. These factors will affect both the need for nonpoint source control and the ability to control some of these sources. As population grows and industrial development continues, given current technology, pollutant inputs from point sources will undoubtedly continue to grow. The finite capacity of the lakes to accept these inputs must be recognized. Appropriate pollutant loading targets must be established, and proper monitoring programs must be undertaken to quantify these loads and insure that the lakes capacity is not exceeded.

Effective strategies at the international, national and local level must be developed to cope with these factors, since they transcend jurisdictional and political boundaries. Flexible management systems and control measures capable of incremental adjustments in response to a changing environment will be required. As well, questions of equity must be taken into account and a formula arrived at for the reasonable allocation of responsibility between governments, institutions and individuals. Above all, it is essential to recognize that the management of nonpoint sources will require a dramatic departure from the traditional approach followed for the control of point sources.

## CONCLUSIONS

The International Joint Commission instructed the International Reference Group on Pollution of the Great Lakes from Land Use Activities to inquire into and report on three questions:

1. *"Are the boundary waters of the Great Lakes System being polluted by land drainage (including ground and surface runoff and sediment) from agriculture, forestry, urban and industrial land development, recreational and parkland development, utility and transportation systems and natural sources?"*

PLUARG finds that the Great Lakes are being polluted from land drainage sources by phosphorus, sediments, some industrial organic compounds, some previously used pesticides and, potentially, some heavy metals, as indicated in the following table.

Phosphorus loads from land drainage and atmospheric deposition contribute to both surface offshore and nearshore water quality problems related to eutrophication. Depending on the magnitude of the point source loads, PLUARG estimated that the combined land drainage and atmospheric inputs to individual Great Lakes ranged from 32 percent (Lake Ontario) to 90 percent (Lake Superior) of the total phosphorus

loads (excluding shoreline erosion). Phosphorus loads in 1976 exceeded the recommended target loads in all lakes. Point source control programs will be sufficient at the present time to meet the target loads only in lakes Superior and Michigan, and southern Lake Michigan may need further measures.

Sediment affects the Great Lakes System primarily as a carrier of phosphorus and other pollutants, and thereby it contributes to the overall pollution of the lakes. Sediment affects nearshore areas through siltation of fish habitat and siltation of drainage channels, harbors and bays which can necessitate expensive dredging.

Toxic substances such as PCBs have been found to gain access to the Great Lakes System from diffuse sources, especially through atmospheric deposition. Through land drainage, residues of previously used organochlorine pesticides (e.g., DDT) are still entering the boundary waters in substantial quantities. Amounts have significantly declined as shown by declining levels in fish tissues. Currently used pesticides do not appear to pose problems.

Mercury has been detected in fish tissues in all the lakes. A continuous buildup of lead in the sediments of the Great Lakes has also been noted. In light of the potential for the methylation of lead, this poses a potential problem of unknown dimensions. Lead enters the Great Lakes System in substantial quantities through atmospheric deposition. It is believed that much mercury enters the system in a similar manner, although this has not been verified.

Microorganisms enter the Great Lakes System from diffuse sources, resulting in localized problems affecting some nearshore waters.

While in many cases it is difficult to ascribe pollution (i.e., violation of a specific existing or proposed water quality objective) to any particular land use, it is important to note that it is the cumulative effect of a variety of land use activities that ultimately contributes to pollution of the Great Lakes.

2. *"If the answer to the foregoing question is in the affirmative, to what extent, by what causes, and in what localities is the pollution taking place?"*

PLUARG finds that the lakes most affected by phosphorus and toxic substances are Erie and Ontario. Local problems associated with phosphorus, microorganisms and sediment are seen in such areas as Green Bay, Saginaw Bay, southern Georgian Bay, Lake St. Clair, the Bay of Quinte, and the south shore red clay area of Lake Superior.



Intensive agricultural operations have been identified as the major diffuse source contributor of phosphorus. The following table indicates the relative loading of phosphorus to each lake from the indicated land uses.

#### GREAT LAKES PHOSPHORUS LOADS

Lake	Total Load <sup>a</sup> (metric tons/yr)	Atmospheric Load (percent of total load)	Total Diffuse Tributary Load (percent of total load)	Estimated Contributions of Major Land Uses to Diffuse Tributary Loads (percent of diffuse load)		
				Agriculture	Urban	Forest & Other
Superior	4,200	37	53	7	7	86
Michigan	6,350	26	30	71	12	17
Huron	4,850	23	50	68	12	20
Erie	17,450	4	48	66	21	13
Ontario	11,750	4	28	66	19	15

<sup>a</sup>1976 load rounded off to nearest 50 metric tons

Erosion from crop production on fine-textured soils and from urbanizing areas, where large scale land developments have removed natural ground cover, were found to be the main sources of sediment. Urban runoff and atmospheric deposition were identified as the major contributors of toxic substances from nonpoint sources.

The most important land-related factors affecting the magnitude of pollution from land use activities in the Great Lakes Basin were found to be soil type, land use intensity and materials usage. For example, intensive agricultural activities such as row cropping (e.g., growing corn, soybeans and vegetables) on soils with fine textures (i.e., high clay content) contributed the greatest amounts of phosphorus. Areas of high phosphorus loading from intensive agricultural activities include northwestern Ohio and southwestern Ontario.

Mercury in the Great Lakes is associated with sediment and, in large measure, reflects "in-lake" redistribution of this material from past industrial point sources. Other sources include municipal and industrial waste water discharges and atmospheric deposition of unknown dimensions, which has resulted in significant tributary loadings throughout the Great Lakes watershed. Highest loadings were observed in Lake Erie.



Diversions, terraces, waterways and contour stripcropping are major mechanical practices that keep soil and pollutants associated with it out of the water. (USDA - Soil Conservation Service)

Eighty-five to ninety-nine percent of the lead in the Great Lakes enters from nonpoint sources. The highest loadings are found in lakes Erie and Michigan. Lead is mainly associated with vehicular emissions and enters the Great Lakes through tributary and atmospheric inputs.

Loadings of organic substances (e.g., PCBs ) enter the Great Lakes via tributaries and atmospheric deposition. Main sources are atmospheric emissions, industrial and municipal point sources and urban diffuse sources.

3. *"If the Group should find that pollution of the character just referred to is taking place, what remedial measures would, in its judgement, be most practicable and what would be the probable cost thereof?"*

PLUARG finds that the remedying nonpoint source pollution will be neither simple nor inexpensive. Nonpoint sources of water pollution are characterized by their wide variety and large numbers of sources, the seemingly insignificant nature of their individual contributions, the damaging effect of their cumulative impact, the intermittent nature of their inputs, the complex set of natural processes acting to modify them and the variety of social and economic interactions which affect them.



PLUARG does not favor across-the-board measures for nonpoint source pollution control. Instead it recommends a methodology which defines problem areas on a priority basis and then applies the most practicable control means for any particular source. Management plans must be formulated which include a number of considerations which have not been comprehensively addressed in past point source control programs. Four major components have been identified: (1) information, education and technical assistance; (2) planning; (3) fiscal arrangements; and (4) regulation.

In addition, the successful implementation of these management plans will rely heavily on the interest, concern and action of individual members of society.

Differences in water quality between and within lakes are the basis for requiring different degrees of management in different watersheds. As a result, implementation programs should be emphasized in those areas of the basin where water quality is the most degraded, or where a need to preserve high quality waters is identified. Remedial program priorities must then be based on the degree to which the pollutant can be controlled.

A basic tool for estimating the level and location of management required in potential pollutant contributing areas is the identification of the most hydrologically active areas (HAA). These are land areas that contribute directly to ground and/or surface waters, even during minor precipitation and snow-melt events, because of their proximity to streams or aquifer recharge areas. The size of hydrologically active areas varies, being a function of land use and management, slope, infiltration rates and soil moisture content.

Developed urban areas, because of their highly impervious, connected surface area and the extensive alteration of their natural hydrology, have large hydrologically active areas. Many developing urban areas are either within a hydrologically active area or on a stream which is tributary to one. Thus, special attention must be given to these areas to insure the control of sediment and associated pollutants.

In agricultural areas, soil conservation techniques can reduce erosion and runoff of sediment and the associated contaminants from hydrologically active areas.

In some timber and pulpwood harvesting operations, it is necessary to protect the most hydrologically active areas in order to avoid water quality problems. A common practice has been the maintenance of buffer strips along open water courses. Location of the most hydrologically active areas is important for siting solid and liquid waste disposal

facilities. This is pertinent when considering not only surface water delivery, but also groundwater contamination. Similar concerns are important for locating disposal areas for mine tailings.

The minimum estimated annual costs to achieve recommended phosphorus target loads are presented in the following table. *These estimated costs are in addition to those of established Great Lakes Water Quality Agreement programs and are based only on economic estimates.* To adhere to the target loads, it will be necessary to adjust programs to balance the effects of population growth and other changes.

### ESTIMATED MINIMUM ANNUAL COSTS TO ACHIEVE PHOSPHORUS TARGET LOADS

millions of dollars							
Lake	United States			Canada			Total Costs
	Point Source	Urban Nonpoint Source	Rural Nonpoint Source	Point Source	Urban Nonpoint Source	Rural Nonpoint Source	
Southern Huron	2.5	7.5	2.5	1.0	0.5	1.5	15.5
Erie	9.0	34.0	12.5	1.5	2.5	10.0	69.5
Ontario <sup>a</sup>	2.5	6.5	Minimal	5.0	7.5	Minimal	21.5
TOTAL	14.0	48.0	15.0	7.5	10.5	11.5	106.5

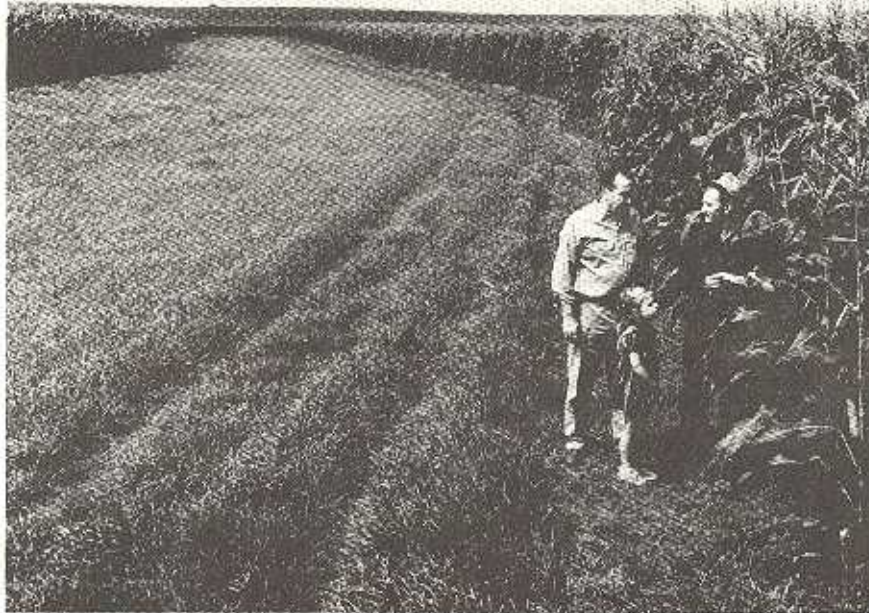
<sup>a</sup>Conditional on Lake Erie target load being met, in order to reduce the annual Niagara River phosphorus input by 1,200 metric tons.

In addition to the foregoing conclusions, the International Reference Group on Great Lakes Pollution from Land Use Activities concludes the following as to:

*"the adequacy of existing programs and control measures"*

Though broad legislative authority, which could be construed as covering pollution from diffuse sources, exists at state, provincial and local levels, specific legislation or rules may be necessary to enable implementation of remedial programs. Some states have already enacted such specific legislation, while others are currently attempting enactment. In the United States, the 1972 and 1977 amendments to the Federal Water Pollution Control Act provide the mechanism for the planning and fiscal aspects of nonpoint source pollution control. The 1977 amendments also improve the sediment control programs by providing assistance on a priority water quality related basis.





Properly maintained grassed waterways reduce erosion. (USDA - Soil Conservation Service)

Federal pesticide control legislation in both countries is deemed to be adequate at present.

Federal legislation and control programs now in development currently appear to be adequate to reduce and eventually eliminate discharges of toxic substances.

The legislation and/or control programs and measures concerning landfills, deep well disposal and forestry operations, where boundary waters are affected, are considered adequate at present. These land uses are not deemed to contribute significantly to the pollution of the Great Lakes. However, local problems related to these activities can occur.

Atmospheric inputs directly to the lakes constitute a substantial portion of the total loads of phosphorus and other pollutants. The quantities of these pollutants being deposited on land, and subsequently reaching the lakes as a result of migration over or through the soil, are only partially known at present.

The level of awareness about pollution from nonpoint sources among Great Lakes Basin residents, is inadequate at present. Control of nonpoint sources will require all basin residents to become involved in

reducing the generation of pollutants through conservation practices. Improved planning and technical assistance are prerequisites to long term solutions of land drainage problems.

A better definition of pollution in the Great Lakes is required. PLUARG found that traditional yardsticks, such as water quality objectives or standards, were insufficient for adequately evaluating the impact of diffuse or nonpoint sources to the Great Lakes. These sources may not in themselves produce violations of water quality objectives. However, in combination with other sources, they can contribute to the overall pollution of the Great Lakes.

The public consultation panels suggested that no additional layers of government be introduced and that present governments more clearly define their objectives regarding pollution control. A renewed commitment and better definition of roles of agencies are required to maximize the utility of existing measures.

A wealth of data currently exists in various institutions throughout the basin. Increased efforts must be made to assess and analyze these data. Due to its dispersal, its availability and potential usefulness is restricted. Current data storage and retrieval mechanisms have been found to be inadequate and require substantial improvement to insure efficient access.

Past Great Lakes research efforts have, for the most part, been piecemeal and without unifying objectives. Future studies on the Great Lakes would be of greater value if they were more holistic in nature. The relationship to the Great Lakes System should be considered as an integral part of new studies.

Greater emphasis must be placed on the study of the nearshore areas and coastal zones of the Great Lakes. Few comprehensive studies have been completed in these areas; yet, they are most affected by man's activities.

PLUARG has contributed new information on the biological availability of heavy metals but has not been able to satisfactorily resolve questions concerning the availability of phosphorus, heavy metals and toxic organic substances or their transmission from different land use activities to the Great Lakes.

Immediate attention must be given to determining whether the Great Lakes ecosystem can maintain its desirable characteristics of diversity, resilience and stability when it is changed by man. Knowledge of the capacity of the Great Lakes System to handle waste loads is required so that tolerable loads can be prescribed.



The most hydrologically active areas in the Great Lakes Basin must be more clearly identified. Future protection of such areas must be provided for through proper land use management, and remedial measures applicable to such areas must be developed.

The potential for Great Lakes pollution from the disposal of radioactive and other toxic wastes is of concern. Unless safe, permanent disposal systems are found for the increasing quantities of exotic and radioactive wastes being produced, hazardous wastes disposal may be a major future problem in the Great Lakes Basin.

# RECOMMENDATIONS

## DEVELOPMENT OF MANAGEMENT PLANS

PLUARG RECOMMENDS MANAGEMENT PLANS, STRESSING SITE-SPECIFIC APPROACHES, TO REDUCE LOADINGS OF PHOSPHORUS, SEDIMENTS AND TOXIC SUBSTANCES DERIVED FROM AGRICULTURAL AND URBAN AREAS, BE PREPARED BY THE APPROPRIATE JURISDICTIONS WITHIN ONE YEAR AFTER THE INTERNATIONAL JOINT COMMISSION'S RECOMMENDATIONS ARE TRANSMITTED TO THE GOVERNMENTS. PLUARG FURTHER RECOMMENDS THAT A MUTUALLY SATISFACTORY SCHEDULE FOR THE REDUCTION OF NONPOINT SOURCE LOADINGS BE ANNEXED TO THE REVISED GREAT LAKES WATER QUALITY AGREEMENT.

### MANAGEMENT PLANS SHOULD INCLUDE:

- (i) A TIMETABLE INDICATING PROGRAM PRIORITIES FOR THE IMPLEMENTATION OF THE RECOMMENDATIONS;
- (ii) AGENCIES RESPONSIBLE FOR THE ULTIMATE IMPLEMENTATION OF PROGRAMS DESIGNED TO SATISFY THE RECOMMENDATIONS;
- (iii) FORMAL ARRANGEMENTS THAT HAVE BEEN MADE TO INSURE INTER- AND INTRA-GOVERNMENTAL COOPERATION;
- (iv) THE PROGRAMS THROUGH WHICH THE RECOMENDATIONS WILL BE IMPLEMENTED BY FEDERAL, STATE AND PROVINCIAL LEVELS OF GOVERNMENT;
- (v) SOURCES OF FUNDING;
- (vi) ESTIMATED REDUCTION IN LOADINGS TO BE ACHIEVED;
- (vii) ESTIMATED COSTS OF THESE REDUCTIONS; AND
- (viii) PROVISION FOR PUBLIC REVIEW.

## PLANNING

PLUARG RECOMMENDS THAT GOVERNMENTS MAKE BETTER USE OF EXISTING PLANNING MECHANISMS IN IMPLEMENTING NONPOINT SOURCE CONTROL PROGRAMS BY:



- (i) INSURING THAT DEVELOPMENTS AFFECTING LAND ARE PLANNED TO MINIMIZE THE INPUTS OF POLLUTANTS TO THE GREAT LAKES; AND
- (ii) INSURING THAT PLANNERS ARE AWARE OF AND CONSIDER PLUARG FINDINGS IN THE DEVELOPMENT AND REVIEW OF LAND USE PLANS.

#### FISCAL ARRANGEMENTS

PLUARG RECOMMENDS THAT A REVIEW OF FISCAL ARRANGEMENTS BE UNDERTAKEN TO DETERMINE WHETHER PRESENT ARRANGEMENTS ARE ADEQUATE TO INSURE EFFECTIVE AND RAPID IMPLEMENTATION OF PROGRAMS TO CONTROL NONPOINT POLLUTION. SUCH A REVIEW SHOULD INCLUDE:

- (i) DETERMINATION OF THE AVAILABILITY OF GRANTS, LOANS, TAX INCENTIVES, COST-SHARING ARRANGEMENTS AND OTHER FISCAL MEASURES;
- (ii) DETERMINATION OF WHETHER OR NOT THE TERMS OF FINANCIAL ASSISTANCE PROGRAMS ARE SUFFICIENT TO ENCOURAGE WIDESPREAD PARTICIPATION; AND
- (iii) DETERMINATION OF THE EXTENT TO WHICH VARIOUS FINANCIAL ASSISTANCE PROGRAMS ARE CONDITIONAL UPON THE IMPLEMENTATION OF NONPOINT SOURCE CONTROLS.

#### INFORMATION, EDUCATION AND TECHNICAL ASSISTANCE

PLUARG RECOMMENDS THAT GREATER EMPHASIS BE GIVEN TO THE DEVELOPMENT AND IMPLEMENTATION OF INFORMATION, EDUCATION AND TECHNICAL ASSISTANCE PROGRAMS TO MEET THE GOALS OF THE GREAT LAKES WATER QUALITY AGREEMENT. THIS EMPHASIS SHOULD INCLUDE:

- (i) DEVELOPMENT OF BROAD PROGRAMS, THROUGH SCHOOL SYSTEMS, THE MEDIA AND OTHER PUBLIC INFORMATION SOURCES, DESCRIBING THE ORIGINS AND IMPACTS OF POLLUTANTS ON THE GREAT LAKES AND ALTERNATIVE STRATEGIES THAT SHOULD BE FOLLOWED BY THE PUBLIC AND GOVERNMENT AGENCIES TO PREVENT WATER QUALITY DEGRADATION;
- (ii) INITIATION OF MORE SPECIFIC PROGRAMS TO IMPROVE THE AWARENESS OF IMPLEMENTORS AND THOSE WORKING IN AND FOR GOVERNMENT, EMPHASIZING THE NEED FOR THE FURTHER CONTROL AND ABATEMENT OF NONPOINT POLLUTION; AND
- (iii) STRENGTHENING AND EXPANDING EXISTING TECHNICAL ASSISTANCE AND EXTENSION PROGRAMS DEALING WITH THE PROTECTION OF WATER QUALITY, INCLUDING RURAL AND URBAN LAND MANAGEMENT PRACTICES.

#### REGULATION

PLUARG RECOMMENDS:

- (i) THAT THE ADEQUACY OF EXISTING AND PROPOSED LEGISLATION BE ASSESSED TO INSURE THERE IS A SUITABLE LEGAL BASIS FOR THE

ENFORCEMENT OF NONPOINT POLLUTION REMEDIAL MEASURES IN THE  
EVENT THAT VOLUNTARY APPROACHES ARE INEFFECTIVE; AND

- (ii) THAT GREATER EMPHASIS BE PLACED ON THE PREVENTATIVE ASPECTS OF  
LAWS AND REGULATIONS DIRECTED TOWARD CONTROL OF NONPOINT  
POLLUTION.

## IMPLEMENTATION OF MANAGEMENT PLANS

### REGIONAL PRIORITIES

PLUARG RECOMMENDS THAT REGIONAL PRIORITIES FOR IMPLEMENTING MANAGEMENT  
PLANS DEVELOPED BY THE JURISDICTIONS BE BASED UPON:

- (i) THE WATER QUALITY CONDITIONS WITHIN EACH LAKE;
- (ii) THE POTENTIAL CONTRIBUTING AREAS (PCA) IDENTIFIED BY PLUARG;  
AND
- (iii) THE MOST HYDROLOGICALLY ACTIVE AREAS (HAA) FOUND WITHIN THESE  
POTENTIAL CONTRIBUTING AREAS.

### CONTROL OF PHOSPHORUS

PLUARG RECOMMENDS THAT PHOSPHORUS LOADS TO THE GREAT LAKES BE  
REDUCED BY IMPLEMENTATION OF POINT AND NONPOINT PROGRAMS NECESSARY TO  
ACHIEVE THE INDIVIDUAL LAKE TARGET LOADS SPECIFIED BY PLUARG.

IT IS FURTHER RECOMMENDED THAT ADDITIONAL REDUCTIONS OF PHOSPHORUS  
TO PORTIONS OF EACH OF THE FIVE GREAT LAKES BE IMPLEMENTED TO REDUCE  
LOCAL NEARSHORE WATER QUALITY PROBLEMS AND TO PREVENT FUTURE DEGRADATION.

### CONTROL OF SEDIMENT

PLUARG RECOMMENDS THAT EROSION AND SEDIMENT CONTROL PROGRAMS BE  
IMPROVED AND EXPANDED TO REDUCE THE MOVEMENT OF FINE-GRAINED SEDIMENT  
FROM LAND SURFACES TO THE GREAT LAKES SYSTEM.



## CONTROL OF TOXIC SUBSTANCES

PLUARG RECOMMENDS THE FOLLOWING ACTIONS BE TAKEN TO REDUCE INPUTS OF TOXIC SUBSTANCES TO THE GREAT LAKES:

- (i) CONTROL OF TOXIC SUBSTANCES AT THEIR SOURCES;
- (ii) CLOSER COOPERATION OF BOTH COUNTRIES IN THE IMPLEMENTATION OF TOXIC SUBSTANCES CONTROL LEGISLATION AND PROGRAMS;
- (iii) PROPER MANAGEMENT AND ULTIMATE DISPOSAL OF TOXIC SUBSTANCES PRESENTLY IN USE;
- (iv) IDENTIFICATION AND MONITORING OF HISTORIC AND EXISTING SOLID WASTE DISPOSAL SITES WHERE THERE IS AN EXISTING OR POTENTIAL DISCHARGE OF TOXIC SUBSTANCES, AND THE IMPLEMENTATION OF CONTROL PROGRAMS AT THOSE SITES AS NEEDED; AND
- (v) JOINT EXPANSION OF EFFORTS TO ASSESS THE CUMULATIVE AND SYNERGISTIC EFFECTS OF INCREASING LEVELS OF THESE CONTAMINANTS ON ENVIRONMENTAL HEALTH AND THE RAPID TRANSLATION OF THESE ASSESSMENTS INTO REFINED WATER QUALITY OBJECTIVES, OTHER ENVIRONMENTAL OBJECTIVES AND, WHEREVER POSSIBLE, TOLERABLE LOADS. FOR CERTAIN TOXIC SUBSTANCES, A ZERO LOAD WILL BE NECESSARY.

## CONTROL OF MICROORGANISMS

PLUARG RECOMMENDS THAT EPIDEMIOLOGICAL EVIDENCE BE EVALUATED TO ESTABLISH APPLICABLE MICROBIOLOGICAL CRITERIA FOR BODY CONTACT RECREATIONAL USE OF WATERS RECEIVING RUNOFF FROM URBAN AND AGRICULTURAL SOURCES.

PRINCIPAL LAND USES OF CONCERN:

### AGRICULTURAL LAND USE

PLUARG RECOMMENDS THAT AGENCIES WHICH ASSIST FARMERS ADOPT A GENERAL PROGRAM TO HELP FARMERS DEVELOP AND IMPLEMENT WATER QUALITY PLANS.

THIS PROGRAM SHOULD INCLUDE:

- (i) A SINGLE PLAN DEVELOPED FOR EACH FARM, WHERE NEEDED;
- (ii) CONSIDERATION OF ALL POTENTIAL NONPOINT SOURCE PROBLEMS RELATED TO AGRICULTURAL PRACTICES, INCLUDING EROSION, FERTILIZER AND PESTICIDE USE, LIVESTOCK OPERATIONS AND DRAINAGE; AND
- (iii) A PLAN COMMENSURATE WITH THE FARMERS' ABILITY TO SUSTAIN AN ECONOMICALLY VIABLE OPERATION.



Gentle side slopes and well established vegetation protect water quality in this creek. (USDA-Soil Conservation Service)

#### URBAN LAND USE

PLUARG RECOMMENDS THE DEVELOPMENT OF MANAGEMENT PLANS FOR CONTROLLING URBAN STORMWATER RUNOFF. THESE PLANS SHOULD INCLUDE:

- (i) PROPER DESIGN OF URBAN STORMWATER SYSTEMS IN DEVELOPING AREAS SUCH THAT THE NATURAL STREAM FLOW CHARACTERISTICS ARE MAINTAINED; AND
- (ii) PROVISION FOR SEDIMENT CONTROL IN DEVELOPING AREAS, AND CONTROL OF TOXIC SUBSTANCES FROM COMMERCIAL AND INDUSTRIAL AREAS.

#### WETLANDS AND FARMLANDS

PLUARG RECOMMENDS THE PRESERVATION OF WETLANDS, AND THE RETENTION FOR AGRICULTURAL PURPOSES OF THOSE FARMLANDS WHICH HAVE THE LEAST NATURAL LIMITATIONS FOR THIS USE.

#### LOCAL PROBLEM AREAS

PLUARG RECOMMENDS THAT THE INTERNATIONAL JOINT COMMISSION, THROUGH THE GREAT LAKES REGIONAL OFFICE, INSURE THAT LOCAL LEVELS OF GOVERNMENT ARE MADE AWARE OF THE AVAILABILITY OF PLUARG FINDINGS, ESPECIALLY AS THEY RELATE TO LOCAL AREA PROBLEMS, TO ASSIST THEM IN DEVELOPING AND IMPLEMENTING NONPOINT SOURCE MANAGEMENT PROGRAMS.



## REVIEW AND EVALUATION OF MANAGEMENT PLAN IMPLEMENTATION

### REVIEW OF IMPLEMENTATION

#### PLUARG RECOMMENDS:

- (i) THE INTERNATIONAL JOINT COMMISSION INSURE REGULAR REVIEW OF PROGRAMS UNDERTAKEN FOR THE IMPLEMENTATION OF RECOMMENDATIONS ARISING FROM THIS REFERENCE; AND
- (ii) THAT NONPOINT SOURCE INTERESTS BE REPRESENTED DURING THESE REVIEWS.

### SURVEILLANCE

PLUARG RECOMMENDS THAT TRIBUTARY MONITORING PROGRAMS BE EXPANDED TO IMPROVE THE ACCURACY OF LOADING ESTIMATES OF SEDIMENT, PHOSPHORUS, LEAD AND PCBs. SAMPLING PROGRAMS:

- (i) SHOULD BE BASED ON STREAM RESPONSE CHARACTERISTICS, WITH INTENSIVE SAMPLING OF RUNOFF EVENTS, WHERE NECESSARY; AND
- (ii) SHOULD BE EXPANDED TO INCLUDE TOXIC ORGANIC COMPOUNDS, TOXIC METALS AND OTHER PARAMETERS AS MAY BE DEFINED IN THE FUTURE.

FURTHER, THE ROLE OF ATMOSPHERIC INPUTS SHOULD BE CONSIDERED IN THE EVALUATION OF GREAT LAKES POLLUTION, WITH SPECIAL CONSIDERATION GIVEN TO DETERMINATION OF THE SOURCES OF MAJOR ATMOSPHERIC POLLUTANTS.

EFFORTS SHOULD BE MADE TO IMPROVE THE COORDINATION BETWEEN DATA COLLECTION AND DATA USER GROUPS, AND TO ESTABLISH AGREEMENTS REGARDING DATA COLLECTION STANDARDS AND ACCESSIBILITY.

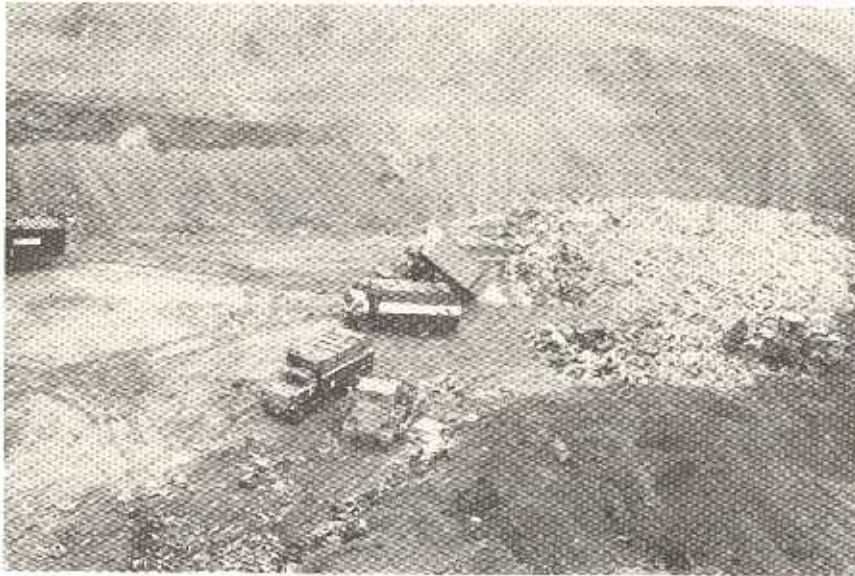
PLUARG FURTHER RECOMMENDS THAT THE ADEQUACY OF UNITED STATES GREAT LAKES NEARSHORE AND OFFSHORE WATER SURVEILLANCE EFFORTS BE EXAMINED.



Developing urban areas should be sodded (as in the area at the left), at the earliest opportunity, to prevent sediment losses. (Environment Canada - Burlington)

## ROLE OF THE PUBLIC

PLUARG RECOMMENDS THAT THE INTERNATIONAL JOINT COMMISSION ESTABLISH A COMPREHENSIVE PUBLIC PARTICIPATION PROGRAM AT THE OUTSET OF FUTURE REFERENCES.



Sanitary landfills should be monitored to detect and deal with toxic substances losses should they occur.  
(Environment Canada - Burlington)