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# Annual Progress Report to the International Joint Commission from the International Reference Group on Great Lakes Pollution from Land Use Activities (PLUARG), July 1975

International Reference Group on Great Lakes Pollution from Land Use Activities

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**INTERNATIONAL REFERENCE GROUP  
ON GREAT LAKES POLLUTION  
FROM LAND USE ACTIVITIES**

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**INTERNATIONAL  
JOINT  
COMMISSION**

**ANNUAL PROGRESS REPORT  
JULY 1975**

*PLUARG  
975*





INTERNATIONAL JOINT COMMISSION  
INTERNATIONAL REFERENCE GROUP  
ON GREAT LAKES POLLUTION FROM  
LAND USE ACTIVITIES



July 1975

International Joint Commission  
Canada and United States

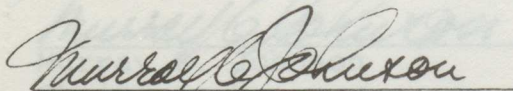
Gentlemen:

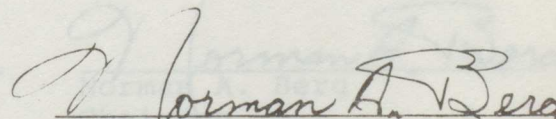
Pursuant to Article VI, Section 1, subsection f (i) of the Great Lakes Water Quality Agreement, and with reference to Section 16 of Directive Number 2 to the Great Lakes Water Quality Board, the Reference Group on Great Lakes Pollution from Land Use Activities takes pleasure in submitting its Sixth Progress Report.

Respectfully submitted,

Canada

United States

  
Murray S. Johnson  
Chairman

  
Norman A. Berg  
Chairman





INTERNATIONAL JOINT COMMISSION  
 INTERNATIONAL REFERENCE GROUP  
 ON GREAT LAKES POLLUTION FROM  
 LAND USE ACTIVITIES

ANNUAL PROGRESS REPORT

July 1975

TO THE  
 INTERNATIONAL JOINT COMMISSION  
 Great Lakes Water Quality Board  
 United States and Canada

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The Reference Group on Great Lakes Pollution  
 from Land Use Activities takes pleasure in transmitting  
 its Sixth Progress Report.

Respectfully submitted,

Canada

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*Murray E. Johnson*  
 Murray E. Johnson  
 Chairman

*Norman A. Berg*  
 Norman A. Berg  
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JULY 1975



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JULY 1975



ANNUAL PROGRESS REPORT

TO THE  
INTERNATIONAL JOINT COMMISSION

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

JULY 1975



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Previous progress reports, prepared semi-annually, described the extent and sources of pollution of the Great Lakes from land use activities and to recommend practicable remedial measures. The work has also been described. This, the first report prepared on an annual basis, is intended to update the International Joint Commission groups, agencies, and individuals on activities during the past year and on problems which have arisen during that period.

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## INTRODUCTION

Previous progress reports, prepared semi-annually, described the origins of this Reference Group, and its directive to assess the extent and sources of pollution of the Great Lakes from land use activities and to recommend practicable remedial measures. The four tasks identified by the Reference Group to accomplish its work have also been described. This, the first report prepared on an annual basis, is intended to update the International Joint Commission, the Great Lakes Water Quality Board, and other interested groups, agencies, and individuals on activities during the past year and on problems which have arisen during that period.

The introductory section will describe general items of interest related to the Reference Group. Detailed descriptions of the status of programs will be presented within the progress reports of the four Task Groups, which follow.



# INTRODUCTION

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## PERSONNEL

### REFERENCE GROUP

Mr. R. G. Code of the Ontario Ministry of Natural Resources has replaced Mr. L. H. Eckel as that agency's representative on the Reference Group.

Mr. Floyd E. Heft, Chief, Division of Soil and Water Districts, Ohio Department of Natural Resources, replaced Mr. C. L. Taylor, Ohio Environmental Protection Agency, who resigned.

### PROGRAM COORDINATOR - TASK GROUP C

Dr. Darnell M. Whitt accepted the position of Task Group C Program Coordinator, and joined the staff of the Regional Office on January 1, 1975. Dr. Whitt provides the necessary coordination of the Task Group C pilot watershed studies, essential to the successful conduct of the program.



# PERSONNEL

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## MEETINGS AND WORKSHOPS

### REFERENCE GROUP

The Reference Group has met on three occasions since July 1, 1974; September 11-13, 1974, in Windsor, January 23-24, 1975, in Toronto, and April 15-16, 1975, in Washington. The Group has scheduled a meeting and field trip for mid-September, 1975.

Numerous meetings have been held by the four Task Groups, as described later in this report.

### WORKSHOPS

In light of the knowledge gained at previous workshops, (for example Guelph, 1973) the Reference Group strongly endorses the concept of holding workshops with invited experts. To this end, the Reference Group is currently pursuing, with the Research Advisory Board, the sponsorship of workshops on the transmission of nutrients from headwaters to boundary waters and on the species and availability of nutrients to biogeochemical cycling in boundary waters. It is anticipated that the Reference Group will continue to pursue this course of action in its search for advice and guidance.



The Reference Group also endorses and plans to participate in the Public Participation Workshop at Ann Arbor, Michigan, sponsored by the Social Sciences, Economics, and Legal Aspects Standing Committee of the Research Advisory Board.

REFERENCE GROUP

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## COORDINATION AND LIAISON

# EARLY ACTION REPORT

The Early Action Report prepared by the Reference Group and submitted to the Board has been endorsed by the Commission and transmitted in the form of recommendations to the respective governments. While the parties are in the process of responding to the Commission's recommendations, the Reference Group would like to again draw to the attention of the Commission and the Board, the apparent lack of coordination of this response among the State and Federal agencies on the United States side. The Reference Group would suggest that the Board and Commission investigate the progress of the implementation of these recommendations and inform the Reference Group. It is hoped that this will provide valuable guidance to the Reference Group regarding the submission of effective recommendations to the Commission in subsequent reports.

## QUALITY OBJECTIVES SUBCOMMITTEE

Liaison between the Reference Group and the Water Quality Objectives Subcommittee has been established. Dr. M. G. Johnson, and Dr. J. G. Kourad, designate for Mr. H. A. Berg, provide input on behalf of the Reference Group.







## COORDINATION AND LIAISON

### COORDINATION WITH THE UPPER LAKES REFERENCE GROUP (ULRG)

The chairmen of the Upper Lakes and Pollution from Land Use Activities Reference Groups met October 3, 1974, in Ottawa, to discuss study areas of common concern. The Pollution from Land Use Activities Reference Group has agreed to provide data on sediment loads derived from tributary inputs and shoreline erosion, and information on land use, physical fabric, specialized land uses, and material usage. Other data requested by the Upper Lakes Reference Group will not be available in time to be used in the preparation of their final report.

### LIAISON WITH THE WATER QUALITY OBJECTIVES SUBCOMMITTEE

Liaison between the Reference Group and the Water Quality Objectives Subcommittee has been established. Dr. M. G. Johnson, and Dr. J. G. Konrad, designate for Mr. N. A. Berg, provide input on behalf of the Reference Group.



## TRIBUTARY MONITORING

PLUARG concerns regarding the need for consistent criteria for use by all agencies in the design of tributary monitoring programs have been transmitted to the Surveillance Subcommittee. These concerns are being addressed and will be considered in the development of a monitoring program. The Reference Group will continue to coordinate its monitoring activities with the Surveillance Subcommittee.

The Reference Group considers the lack of mainstem (upstream) monitoring on the Grand and Maumee watersheds a major gap in the watershed program. Initiatives are presently underway to have these corrected through State programs; however, the Reference Group would like to draw this problem to the attention of the Board for consideration.

## LIAISON WITH THE DATA QUALITY SUBCOMMITTEE

The Reference Group has nominated Dr. D. M. Whitt, Task Group C Program Coordinator, to represent the Reference Group on the newly created Data Quality Subcommittee. Dr. Whitt's participation will ensure that the special needs of the Reference Group are recognized, and considered.



CORPS OF ENGINEERS LAKE ERIE WASTE WATER MANAGEMENT STUDY

The Board had previously agreed that PLUARG and Corps' studies on Lake Erie be coordinated. This is to be accomplished informally through Corps' membership on the Task C Technical Committee and through liaison with the Reference Group member from Ohio.

INNOVATION DIFFUSION AND THE ADOPTION OF REMEDIAL MEASURES

At the April meeting of the Reference Group, the representatives of Task A tabled a research proposal directed towards improving the final Reference Group response to one of the questions asked of the IJC by the two Governments. This question was as follows:

"If the Commission 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?"

This study which will examine the consequences of the diffusion of innovations among the rural farm population of the basin, especially those with environmental implications, was presented to the Research Advisory Board on May 29/75 for their support. The Board has referred this proposal to the Social Sciences, Economics and Legal Aspects Standing Committee for assistance in preparing a final study plan.

Hopefully, this study can be managed with the fiscal resources available to Task A, but it may be necessary to have additional funding to carry out an adequate study in both countries.



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The Board had previously agreed that PLUARC and Corps studies on Lake Erie be coordinated. This is to be accomplished through Corps' membership on the Task C Technical Committee and through liaison with the Releasee Group member from Ohio.

INNOVATION DIVISION AND THE ADOPTION OF REMEDIAL MEASURES

At the April meeting of the Releasee Group, the representatives of Task A tabled a research proposal directed towards improving the final Releasee Group response to one of the questions asked of the JOC by the two Governments. This question was as follows:

"If the Commission 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?"

This study which will examine the consequences of the dilution of phosphorus, under the total phosphorus limitation, especially those with environmental implications, was presented in the Research Advisory Board on May 25, 1973. The Board has related this proposal to the Social Sciences Research Council and the Standing Committee for assistance in preparing a final study. Hopefully, this study can be managed with the fiscal resources available to Task A, but it may be necessary to have additional funding to carry out an adequate study in both countries.



## PUBLICATION POLICY

The Reference Group has adopted the following policy statement regarding publications arising from PLUARG activities:

Prior to the release of the Reference Group's main report, the publication policy will provide for publication of researcher's results in refereed scientific journals in accordance with the requirements of the journal and the scientist's employer, subject to prior approval by the funding agencies, where applicable, with copies of all manuscripts and reprints to be provided to the Reference Group for notification and information.

Papers submitted to scientific journals are to include an acknowledgement of funding support from the specified agency(ies) under the PLUARG program and a disclaimer that publication does not constitute acceptance by the International Reference Group on Great Lakes Pollution from Land Use Activities.

the IJC Regional Office. On the Canadian side an unpublished report has been prepared entitled "The Relationship Between Great Lakes Water Quality and Existing Land Use and Management Practices in the Basin".

At the two joint meetings of the task group held on July 10-11, 1974 and March 1-4, 1975 and at other informal get togethers, the members have moved toward the preparation of a joint summary report



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## TASK A REVIEW

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

In keeping with the terms of reference under the PLUARG study plan, Task A has developed a series of state-of-the-art reports in which the current state of knowledge regarding management practices, regulations and the present and potential degree of pollution are discussed. These reports have been collated on the U.S. side into a two-volume document entitled "Management Programs, Research and Effects of Present Activities on Water Quality of the Great Lakes", Nov., 1974. These volumes have received wide distribution through the IJC Regional Office. On the Canadian side, an unpublished report has been prepared entitled "The Relationship Between Great Lakes Water Quality and Existing Land Use and Management Practices in the Basin".

At the two joint meetings of the Task Group held on July 30-31, 1974 and March 1-4, 1975 and at other informal get togethers, the members have moved toward the preparation of a joint summary report



reviewing their findings, highlighting the potential problem areas and knowledge gaps, and identifying additional Early Action items. In the report Task Group A will make recommendations to the Reference Group and to the research community in the Great Lakes Basin concerning those areas requiring further study. This report will be completed and ready for submission to the International Joint Commission at its July meeting.

A report outlining additional and future research needs, will be prepared and submitted to the Research Advisory Board. Similar reports, with respect to remedial measures and social and economic considerations will be prepared in the future.

During the year Mr. G. E. Bangay joined the Task Group in the role of coordinator to ensure the compatibility and uniformity of the U.S. and Canadian activities.

In reply to the Early Action recommendations submitted by Task Group A in March 1974, the Governments of Canada and Ontario have detailed the programs to be implemented to meet these needs. Further early action recommendations will be presented as they are identified.

In order to evaluate the efficiency and merit of the remedial measures available, Task Group A plans to undertake studies to determine the acceptability of the remedial measures to the general population and the various agencies responsible for management of land use activities in the Basin. These studies will require the assistance of individuals and agencies outside of the Reference Group for study design and implementation.



## TASK B REVIEW

*Inventory of land use and land use practices, with emphasis on certain trends and projections to 1980 and, if possible, to 2020.*

The U. S. and Canadian Sections of Task Group B have met on three occasions during the past year. Arrangements have been made to insure comparable formatting of U. S. and Canadian data. The final Task B reports will be compiled by activity within each lake basin. In other words, each volume will describe general land use, specialized land uses, physical fabric, material usage, and future trends within a specific lake basin.

### U. S. ACTIVITIES

#### Activity B-1 (General Land Use Inventory)

Land Use classification of the 191 counties in the Great Lakes Basin being conducted by LARS (Laboratory for the Application of Remote Sensing) at Purdue University is virtually complete. The LARS output will consist of statistical tables, defining land use by county, and maps depicting land use by county. Counties will be aggregated into Planning Subareas, and land use maps for each Planning Subarea will be prepared.



The investigation of alternative methods of obtaining maps free of geometric distortion had delayed completion of this activity. This Task Group has, however, recently agreed to retain the Mead Corporation to prepare land use maps from the digital data. It is anticipated that this activity will be completed by June, 1975.

Activities B2 - B5 (Specialized Land Uses, Physical Fabric, Material Usage, And Future Trends)

These activities are being conducted by the Great Lakes Basin Commission. Excellent progress is being made on these activities; draft reports have been completed and are under review.

CANADIAN ACTIVITIES

Activity B-1 (General Land Use Inventory)

The preparation of maps depicting Land Use in the Canadian portion of the Great Lakes Basin is anticipated to be completed in June, 1975. Approximately 33 maps depicting land use in each of the minor watersheds in the Basin will be prepared at a scale of 1:250,000. Two maps of the major watersheds at a scale 1:500,000 will be prepared. Land use composition will be identified through use of graphs indicating the percentage of land use within each major and minor watershed.



Activity B-2 (Specialized Land Uses)

This activity has been completed. A report describing specialized land uses, prepared by Chrysler and Latham Consultants, is available in the Regional Office.

Activity B-3 (Physical Fabric)

Completion of this activity is scheduled for July 1975. Data on soils, geology, geomorphology, hydrology, climate, population, economic activity, etc., is being collected, and will be presented by county and watershed.

Activity B-4 (Material Usage)

All data collection activities have been completed. Draft narrative summaries, data tabulations and maps are under review by Task Group B members.

Activity B-5 (Future Trends)

A model is under development to forecast changes in land use that may affect drainage. Data have been collected on population trends and urbanization and efforts are underway to commence institutional analysis. December 1975 is the tentative completion date for this activity.



Activity B-2 (Specialized Land Uses)

This activity has been completed. A report describing special-ized land uses, prepared by Chrysler and Larson Consultants, is available in the Regional Office.

Activity B-3 (Physical Fabric)

Completion of this activity is scheduled for July 1975. Data on soils, geology, geomorphology, hydrology, climate, population, economic activity, etc., is being collected, and will be presented by county and watershed.

Activity B-4 (Material Usage)

All data collection activities have been completed. Narrative summaries, data tabulations and maps are under review by Task Group B members. Data collection was in progress in 1974. Activity B-3 (Physical Fabric) was completed in 1974. A scale of 1:50,000 is being used. -Detailed land development, to forecast changes in land use patterns, has been collected on population trends and distribution and efforts are underway to commence regional analysis. December 1975 is the tentative completion date for this activity.



## TASK C REVIEW

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

The Task Group C Technical Committees have met ten times during the past year.

### U. S. - CANADA COORDINATION - TASK GROUP C

Considerable efforts have been made to ensure effective coordination of the various U. S. and Canadian pilot watershed studies. Recognizing that the maximum benefits of the joint Task Group C programs will be achieved if the final outputs from the pilot watershed studies are compatible, the Technical Committees have taken the actions detailed below:

#### Standardized Parameter List

The Technical Committees have developed and adopted a list of standard chemical and physical constituents to be determined on a



routine basis for all water and soil samples collected within the pilot watersheds.

### Quality Control Program

Initial discussions regarding the development of a quality control program for all Task Group C studies were held in July 1974 in East Lansing, Michigan. Subsequent to these discussions, four sub-groups have met to refine comparable methodologies for monitoring network design, sampling techniques, analytical procedures, and data management. Recommendations from these groups are being circulated to all program participants.

### Data Management

A sub-group has been established to prepare recommendations for the establishment of a standardized format for the Transfer of Task Group C data. This standardized format is being developed to ensure data compatibility and facilitate the exchange of data between all task C watershed studies. The Regional Office of IJC may wish to serve as a data repository for all pilot watershed data.

### Modelling

A modelling sub-group has been established to refine approaches to watershed modelling, and review proposed Task Group C studies to



ensure that data being generated are appropriate for the development of suitable predictive models.

#### Sediment Analytical Methodology

A sub-group on sediment analytical methodology was formed and met on May 8-9, 1975, at Ann Arbor, Michigan, to identify sediment parameters which should be determined in all pilot watersheds.

Dr. D. M. Whitt, Task Group C Coordinator, is playing a major role in the coordination of these studies.

#### U. S. ACTIVITIES

During the past twelve month period, considerable work on initiation of the pilot watershed studies has been conducted. Detailed work plans have been prepared, reviewed and approved by the Technical Committee and the U. S. EPA, and installation of monitoring equipment has progressed satisfactorily. U. S. EPA is in the process of bringing funding on all watershed studies up to the originally requested level. Details of the status of the various pilot watershed studies are presented below.

#### Maumee River Watershed Study

Five small agricultural watersheds (2-12 acres in size) have been selected for study in Defiance County, Ohio. Sites selected for study



are being instrumented and it is anticipated that required equipment will be installed shortly. A preliminary work plan has been drafted and revised to conform more closely to Task Group C study objectives. The revised work plan has been approved by Task Group C and U. S. EPA. However, a responsible agency to provide mainstem water quality monitoring has not yet been identified.

### Genesee River Watershed Study

The Genesee Watershed Study is progressing on schedule. The design of the Water Quality Network has been completed, and sampling at a total of thirty water quality and sediment sampling stations was initiated March 1, 1975.

An internal quality control program has been developed, and a data management system has been adopted. Progress in data analysis includes the development of a simulation model for bedload and suspended load transport in stream channels; implementation of the Wisconsin Hydrologic Transport Model for Spring Creek, and the Soil Loss Model for Avon Creek watershed; and assembly of an inventory of all point sources of pollution in the Genesee Basin to permit the development of phosphorus and nitrogen budgets.

In addition to proposed water quality and quantity monitoring, a total of 9 special studies have been developed to provide detailed information on some of the processes by which land use may affect water quality.



## Menomonee River Watershed Study

Good progress is being made in the Menomonee River Watershed study. A total of 12 monitoring stations have been selected for the installation of automatic water quality and sediment samplers. Operation of the automatic sampling equipment was initiated in January 1975. Additionally, 5 grab sample stations have been selected. Sampling at these stations has been in progress since February 1974.

A single survey was conducted in October 1974, for toxic organic compounds at eight selected sites throughout the watershed. A re-survey is planned for early June 1975. Similar surveys are planned to locate source areas that may be related to seasonal events.

Coincident with the monitoring activities, a detailed land use inventory is in progress to characterize land use patterns within the watershed. In addition, the basic components necessary for the development of a predictive model for the watershed have been conceptualized and are now being refined.

## Felton-Herron Creek Watershed Studies

Investigations of the effect of drainage from a liquid waste disposal area to Felton-Herron Creek, a tributary of the Grand River, are underway. Efforts are being completed to implement a computer-based data acquisition and control system for the study.

The total wastewater management system at Michigan State University is now operational, and investigations on the relationship of



temperature, snow and ice cover to infiltration at a spray irrigation facility are underway. Additionally, run-off characteristics of a small watershed subjected to winter application of wastewater are being studied.

A detailed program of chemical monitoring on Felton-Herron Creek has been initiated. Samples are collected at seven stations every three weeks, and during periods of rising hydrographs. Microbiological monitoring for pathogens and viruses is being conducted on Felton Creek.

Soil and vegetation surveys in the area receiving wastewater irrigation are planned for the 1975 field season.

#### Mill Creek Watershed Study

Studies on the impact of an intensive orchard farming area on water quality will be conducted in the Mill Creek Watershed. The stream gauging and water quality monitoring network has been established, and a rain gauge network has been designed and will be installed shortly.

Monitoring has been initiated for pesticide residues in Mill Creek. A computerized use pattern survey has been developed to inventory pesticide usage in the agricultural portion of the watershed, and an infrared aerial survey of the watershed is being conducted to permit the preparation of source area maps.



## Streambank Erosion Study

The Streambank Erosion Study on the Maumee River has been completed, and preliminary data describing the tons of erosion per year, and the acres lost annually by erosion, are now available. Similar studies have been initiated for the Menomonee River, the Mill Creek (Michigan), the Black Creek (Indiana), and two sub-watersheds in the Genesee River. These will be used to determine the contribution of streambank erosion to stream sediment load in the U. S. pilot watersheds.

## CANADIAN ACTIVITIES

### Activity 1 - Agricultural Watershed Surveys

Phase I studies to assess the impact of agriculture on water quality in 16 small watersheds were completed in September 1974. Analysis of data generated in these preliminary studies permitted the establishment of objectives and priorities for detailed Phase II studies. Proposals to achieve study objectives in six representative watersheds were solicited from various universities, consultants and research establishments.

Following their review by an ad hoc committee, twenty proposals were accepted for funding. These proposals will investigate the effect of agricultural practices on water quality. They include studies of precipitation quality; nutrient sources, transformation,



transport and modelling; soil characteristics, erosion and transport; and microbiological aspects.

Regular monitoring of stream flow and water quality was continued in the watersheds selected for Phase II studies and at the outlets of five additional watersheds.

Other studies being conducted under this activity include an inventory of farm practices; fertilizer, manure, and pesticide use in the agricultural watersheds; comparison of water quality data from a small watershed with that of a large watershed (completed); and feedlot and manure run-off studies.

A tour of the Canadian agricultural watersheds was held from June 9-13, 1975.

#### Activity 2 - Forested Watershed Studies

On-going studies on the effect of forestry operations on water quality, conducted by the Canadian Forestry Service of Environment Canada in the Winnipeg Area Basin are progressing well.

#### Activity 3 - Study of Pollution and Adequacy of Controls Related to Urban Development, Transportation, Utility and Extractive Industries, and Waste Treatment and Disposal Uses

Investigations of changes in pollutants during stream transport and of the effects of specific land uses are being conducted mainly



in the pilot watersheds of the Grand and Saugeen rivers and Wilton Creek. The studies of urban runoff, sanitary landfill, and sewage sludge disposal are co-ordinated and integrated with on-going investigations under the Canada-U.S. and Canada-Ontario Great Lakes Water Quality Agreements.

### 3.1 Urban Watershed Studies

Six watersheds have been selected for study to determine the significance and magnitude of inputs from municipal land drainage. Intensive monitoring activities will be conducted during 1975 and 1976.

### 3.2 Extractive Industries

Two sites have been selected and instrumented for detailed monitoring during the 1975 field season.

### 3.3 Transportation Areas

A program has been initiated to determine inputs from routine highway maintenance over a 0.8 mile highway corridor. Detailed monitoring will continue in 1975.

### 3.4 Sewage Sludge Disposal Studies

A site has been selected in the Grand River Basin to study the impacts on water quality of the practice of disposing processed



organic wastes on agricultural land. It is anticipated that flow measuring and sampling equipment, and collection channels will be installed in the spring of 1975. A second site will likely be selected in 1975.

### 3.5 Private Waste Disposal Studies

Three sites have been selected for study and several others are being checked for suitability. Pilot studies conducted in 1974 at two sites adjacent to Lake Huron to evaluate study techniques and equipment provided preliminary data on pollutant movement through clean sands.

### 3.6 Sanitary Landfill Studies

Studies on leachate movement from seven sanitary landfill sites are progressing on schedule. Two of the sites have been instrumented and are being sampled with PLUARG support; the others are under the federal Great Lakes water quality program. The development of attenuation factors for various soils has been successful, and it is hoped that this information can be used to estimate the potential effects of sanitary landfills on water quality.

### Activity 4 - Water Quantity and Quality Monitoring Network

A total of 64 water quality and quantity monitoring sites has been selected for activities 1, 3 and 4. Existing streamflow gauging



installations have been supplemented with 16 new stations. Of this total, 33 stations form the basic network.

#### Activity 5 - Laboratory Support For Water Quality Monitoring and Pollution Source Studies

Laboratories of the Ontario ministries of Agriculture and Food and the Environment analyzed the bulk of the samples from the field studies initiated in 1974. Canada Department of Agriculture and university laboratories have joined them in providing analytical support for the detailed investigation begun in April 1975.

#### Activity 6 - Riverbank Erosion Surveys

A preliminary ranking of 16 watersheds regarding their relative potentials for bank erosion is completed. Monitoring of stream bank erosion to determine bank recession mechanisms, and quantities and qualities of eroded materials, will be conducted during 1975, using a stereometric photographic technique.

##### Sub-Activity 1

The compilation of available information on erosion for the calculation of sediment loadings is contained in the technical volumes of the shoreline damage report.



installations have been supplemented with 16 new stations. Of this total 13 installations form the basic network and 3 are supplementary. The basic network will consist of 16 stations and 3 supplementary stations. The supplementary stations are located at the following locations: ...

Laboratories of the Ontario Ministry of Agriculture and Food and the Environment analysed the bulk of the samples from the field studies initiated in 1971. Canada Department of Agriculture and Food in 1971 in determining the need for such studies and university laboratories have joined them in providing analytical support for the detailed investigation begun in April 1972. The support was provided by the following laboratories: ...

Activity 2 - Riverbank Erosion Surveys

A preliminary ranking of 18 watersheds regarding their relative potential for bank erosion is completed. Monitoring of stream bank erosion to determine bank erosion mechanisms, and quantities and qualities of eroded materials, will be conducted during 1972. The erosion studies are being conducted in the following watersheds: ...

Activity 3 - Water Quantity and Quality Monitoring Network

A total of 25 water quality and quantity monitoring stations has been selected for 1972. The stations are located at the following locations: ...



## TASK D REVIEW

*Diagnosis of degree of impairment of water quality in the Great Lakes, including assessment of concentrations of contaminants of concern in sediments, fish and other aquatic resources.*

Members of Task Group D have met five times during the past year. In addition, many meetings of the individual sections were held.

### CANADIAN ACTIVITIES

#### Activity 1 - Assessment of Shoreline Erosion

The bulk of data requirements for this activity is being developed as part of the study of shoreline damage under the terms of the Canada-Ontario Agreement. A summary report of this Canada-Ontario study has been completed and the technical report is in the final stages of preparation.

#### Sub-Activity 1

The compilation of available information on erosion for the calculation of sediment loadings. - Contained in the technical volume of the shoreline damage report.



## Sub-Activity 2

The evaluation of stratigraphy of profiles to calculate the mean annual loading of stratigraphic horizons lost to the lake by shoreline erosion. - The profile logging has been completed.

## Sub-Activity 3

To sample the profiles on a stratigraphic basis to conduct various chemical and physical analyses:

(a) Particle size analysis - analysis completed

(b) Geochemical analysis - analysis is continuing on a satisfactory schedule despite some delays because of instrument breakdown.

(c) Determination of the forms of phosphorus - analysis is underway. Data developed to date indicate that phosphorus in Lake Erie and Lake Ontario bluff materials occurs predominantly as apatite. Solubility determinations show that the phosphorus in bluff materials is not readily available.

## Sub-Activity 4

Engineering properties of erodible bluffs relative to dispersion of wave energy in order to elucidate the major mechanisms of erosion and evaluate the efficiency of protective structures. - Plans are being developed to conduct these studies in Lake Erie during the upcoming year.



### Sub-Activity 5

To investigate mineralogy of bluff materials to observe stratigraphic variation, and to relate variations to engineering properties determined in Activity 1.4. - Identification of the heavy mineral components is underway.

### Sub-Activity 6

Determination onshore/offshore movement of sediments by wave induced erosion. - Field measurements of the lake bed profiles from shore to 20 meters water depth are continuing.

It is expected that the bulk of investigations associated with activity one will be completed and a report to the Reference Group will be prepared within the upcoming year.

Studies in erodible bluff areas of Lake Superior will be undertaken shortly by the Canada Centre for Inland Waters and information generated from these investigations will provide additional input to Canadian Task D studies.

## Activity 2 - Survey of River Sediments and Water Quality

As described in sub-activities 2.1 and 2.2 which follow, Canadian studies to meet the objectives of Activity 2 are centered around: a detailed evaluation of historical water quality and streamflow



records kept for all significant streams flowing to the Ontario side of the Great Lakes; and an extensive sampling program where all significant streams draining to the Canadian portion of the Great Lakes are sampled at their mouths for suspended particulate matter during the spring run-off period. Sediment samples thus collected are analyzed for a wide variety of chemical constituents. This spring run-off sampling program is augmented by a similar year-round program where samples are collected at three week intervals at the mouths of a few rivers considered to be representative of a wide cross-section of land use activities found in Ontario.

### 2.1 Evaluation of Existing Data

A compilation and evaluation has been made of all available data pertaining to discharge, water quality, geology and geomorphology of all (Canadian) tributary drainage to the Great Lakes. All data processing and analysis was carried out in the Department of Geography at Queen's University under contract to Environment Canada.

All work completed appears in a five volume report entitled "Hydrophysical Characteristics of Great Lakes Tributary Drainage, Canada".

### 2.2 River Mouth Surveys

Field work during 1975 continued with the sampling of suspended solids from streams tributary to lakes Erie and Superior.



This sampling was completed by the end of May and samples are presently being prepared for analysis. Analysis of samples from the 1974 field sampling for lakes Ontario, Huron and Georgian Bay are approaching completion.

Sediment quality monitoring based upon a three-week sampling interval has been commenced on the Grand Thames and Muskoka rivers; a similar sampling of the Niagara, Credit, Humber and Bronte, conducted during 1974, was completed at the end of March 1975. Preliminary data from the 1974-75 stream monitoring program show interesting results. Firstly, the variation in stream sediment quality during the year was small, indicating a remarkable constancy in the quality of sediment derived from a single watershed. Secondly, the fractionation analysis of the sediment-bound phosphorus indicated that much of the phosphorus is organic and non-apatite inorganic phosphorus (NAIP) form. This data is summarized in the following table.

Table - Forms of P in suspended solids in streams monitored during 1974-75.

m = mean                      cv = coefficient of variation

	Total P		APAP (Apatite P)		NAIP		ORG P.	
	m ppm	cv %	m ppm	cv %	m ppm	cv %	m ppm	cv %
Welland	1044	11.9	597	5.4	180	22.4	187	18.8
Credit	1174	12.2	449	7.6	419	22.2	353	24.7
Niagara	-	-	362	24.0	306	23.8	-	-
Bronte	1443	33.1	401	14.4	427	45.9	650	49.8
Humber	2022	38.1	490	5.3	676	39.6	709	64.4



This fractionation of phosphorus is distinctly different from the shoreline bluff material analyzed to date in which the phosphorus is predominantly apatite.

### Activity 3 - Effects of River Inputs

The general objectives of this activity are to assess the extent and significance of specific contaminants from land use activities with respect to aquatic life and water uses such as municipal supply. The bulk of activities planned to answer these objectives must await an analysis of data derived from Task D Activities 1 and 2 studies. As indicated in previous sections, these evaluations are now or shortly will be available. It is expected that most of the sub-activities in Activity 3 will be underway in 1975.

#### 3.1 Review of Activity 1 and 2 Data

As indicated, most of these data will be available early in 1975. In addition to reviewing these findings, a plan is being finalized to conduct an evaluation of historical nearshore Great Lakes water quality records collected since 1967 by the Ontario Ministry of the Environment. These data will be analyzed in detail to identify temporal and three-dimensional spatial patterns of water quality throughout the nearshore zone and to establish possible relationships between water quality in the lakes and tributary discharges (measure in Activity 2), shoreline erosion (from Activity 1) or other factors such as major landfill projects.



### 3.2 Laboratory Simulations

Programs are currently underway utilizing lake column simulators to determine contaminant pathways and transfer mechanisms in the lake system in order to determine biological availability and effect of materials transported to the lakes.

### 3.3 Biological Field Investigations

### 3.4 Synthesis of Information to Relate Impairment to Material Inputs

As indicated earlier, information from Activities 1 and 2 are necessary pre-requisites to the planning of these sub-activities. With the background material now becoming available, sub-activities 3.2, 3.3 and 3.4 will be fully developed over the next two study years.

### 3.5 Assessment of the Spatial Extent of Turbidity by Remote Sensing

A project is currently being undertaken to employ ERTS imagery to identify areas of water quality impairment, as indicated by turbidity, around the Canadian shoreline of the Great Lakes. The findings of this investigation will lead to more detailed ERTS data evaluations in selected areas. A study of the application of the various ERTS bands is continuing. Currently, it appears that bands 4 and 5 will provide useful data on the relationship of turbidity and



suspended biomass. A detailed analysis will be undertaken to compare the findings of this sub-activity and the water quality data banks described in sub-activity 3.1.

### 3.6 Lake Sediments for Pesticides Analysis

Lake Erie Sediments - Two hundred and sixty-one bottom sediments collected in 1971 were analyzed for organochlorine insecticides and pollutants representing 783 analyses.

Samples of lake sediment collected during 1970 and 1974 from Lake St. Clair will be analyzed in the near future to evaluate the time variation in concentration and distribution of pesticides in this system.

## U. S. ACTIVITIES

During the past year a Technical Committee of ten members was formed. This Technical Committee will facilitate planning and provide the overall guidance and support required for the conduct of this task. A revised detailed study plan has been developed, approved by the Reference Group, and submitted to the Water Quality Board for approval.

### Activity D-1 (Shoreline Erosion)

#### 1.1 Determination of Quantity and Quality of Eroded Material



## 1.2 Overview Determination of Pollutant Loadings from Shoreline Erosion

A contract has been let to the Great Lakes Basin Commission for Sub-Activities 1 and 2, except for chemical and physical analysis of shoreline samples which will be collected as part of the Shoreline Erosion Study of the U. S. Corps of Engineers. A proposal has been made by the Division of Labs & Research, State of New York, to do the analysis of the shoreline erosion samples. Target completion date for Sub-Activities 1 and 2 is August 1975.

## Activity D-2 (Survey of River Sediments and Associated Water Quality)

### 2.1 (a) and (b) Identification and Evaluation of Existing River-Mouth Loading Data

A proposal from the Great Lakes Basin Commission has been received for this work and is being processed.

### 2.2 New Tributary Surveys

This Sub-Activity is dependent on the identification of the necessary workload by Sub-Activity 2.1 (a) and (b). Additional stream surveys will be conducted only where it is imperative to obtain additional data to assess the total input to the lakes. No new large scale extensive stream mouth surveys are intended to be done in this Sub-Activity. A meeting regarding tributary monitoring has



been arranged with representatives of the Upper Lakes Reference Group. The States have provided cost estimates for an intensive daily sampling program at selected tributary mouths where United States Geological Survey gauges are available to support work of this group. Included in the analytical work will be the parameters needed by Task D.

### 2.3 Estimate of Total Tributary Loading

### 2.4 An Alternate Approach to Predicting the Effect of Land Use on Stream Water Quality

### 2.5 Availability of Pollutants Associated with Suspended or Settled River Sediments which Gain Access to the Great Lakes

D-2 Sub-Activities will be addressed during the early part of FY 1976.

### Activity D-3 (Effects of River Inputs)

#### 3.1 Sediment Dispersion and Water Quality Offshore of River Mouths

The study on "Effect of Maumee River Input on Lake Erie During Peak Flow" was completed. It was a pilot study conducted by the National Aeronautics and Space Administration, Lewis Research Center and the Ohio State University Center for Lake Erie Area Research. A preliminary report was submitted on April 21, 1975. The results were promising and it appears that correlation between



multi-spectral scanning data and dispersed pollutants will be established. A detailed evaluation and recommendations for future applications of this technique will be presented in a summary report scheduled for July 1, 1975.

### 3.2 Assessment of the Degree of Contamination of Organisms in Areas Exposed to Higher-Than-Average Loadings

### 3.3 Significance of Wind-Induced Mixing on the Uptake or Release of Substances Associated with Sedimented Material in Nearshore Areas of the Lakes

(a) Samples will be taken at different strategic locations in the pilot watershed stream discharge areas and possibly in other strategic locations (e.g., Saginaw Bay, Green Bay, Western Lake Erie), during or immediately following wind events, and analyzed for selected nutrients, pesticides, metals, and refractory organics and other appropriate parameters related to the effects of land drainage.

(b) A survey of the frequency and extent of storm-induced sediment/water mixing of nearshore areas and embayments will be made.

### 3.4 Critical Assessment of Water Quality Impairment Resulting from Land Drainage

(a) A critical assessment will be made of the overall significance of contaminants, including nutrients, pesticides, heavy metals, and refractory organics, which enter the Great Lakes and which are attributable to land runoff from the U.S. side.



(b) A quantitative assessment of the pollutant loading from U.S. land drainage as determined in Subactivity 2-3 relative to atmospheric inputs directly to the lake, point source inputs and shore erosion inputs will be made.

These Sub-Activities will be addressed during early FY 1976.

#### Activity D-4 (Tasks C/D Interface)

##### Subactivity 1 -

Members of Task C and Task D will form a special task group to compare different methods used to compute the total tributary loading to the Great Lakes. The methods compared will include:

- (1) total loadings based on the extrapolation of the pilot watershed data to the other watersheds throughout the Basin (done by Task C)
- (2) total loadings based on tributary river mouth input
- (3) total loadings based on land use unit loading rates (non-point source input) and direct point source discharges.

A comparison will be made of these three methods and any other methods available, including the utility and cost/benefits of these different approaches. The results of availability/exchangeability data as generated in Tasks C and D will also be considered in the estimation of total tributary loading from land drainage.

This activity will be addressed during early FY 1976.



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