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# **The Canada Water Act**

## **Annual Report**

**1986-87**

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# **The Canada Water Act**

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**1986-87**

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Minister of the Environment



Ministre de l'Environnement

Ottawa, Canada K1A 0H3

Her Excellency,  
The Right Honourable Jeanne Sauv , C.C., C.M.M., C.D.,  
Governor General of Canada,  
Rideau Hall,  
Ottawa, Canada.  
K1A 0A1

Madam,

I respectfully submit to Your Excellency and to  
the Parliament of Canada the annual report on operations  
under the Canada Water Act for the fiscal year 1986/87.

I have the honour to be, Madam, Your Excellency's  
obedient servant,

A handwritten signature in black ink, appearing to read "Tom McMillan".

Tom McMillan, P.C., M.P.  
Hillsborough

Minister of the Environment



Sous-ministre  
Environnement Canada

Deputy Minister  
Environment Canada


Ottawa, Canada  
K1A 0H3

The Honourable Tom McMillan, P.C., M.P.,  
Minister of the Environment,  
Ottawa, Canada.  
K1A 0A6

Dear Mr. McMillan,

I have the honour to submit the Annual Report on operations  
under the Canada Water Act, for the fiscal year 1986-87.

Sincerely,

  
for G.A. Sainte-Marie

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## INTRODUCTION

The Canada Water Act, proclaimed on September 30, 1970, provides the framework for joint federal-provincial management of Canada's Water resources. Section 36 of the Act requires that a report on operations under the Act be laid before Parliament as soon as possible after the end of each fiscal year. This, the fifteenth annual report, covers operations to March 31, 1987.

On September 30, 1985, the Advisory Committee appointed to undertake an Inquiry on federal water policy presented its report to Mr. McMillan. A federal Interdepartmental Task Force, formed to consider the Inquiry's report, reported to Mr. McMillan in 1986. More details are given on page 3.

Up to and including fiscal year 1975-76, Canada Water Act funding was provided on the basis of individual projects. In fiscal year 1976-77, Treasury Board established a ceiling on expenditures cost-shared with the provinces (for river basin planning and implementation, and flood damage reduction) at about an \$18 million per year level. Subsequently, budget reductions and consequent adjustments to the program have lowered the ceiling in 1984-85 to about \$11 million. This total fell to \$9.2 million for 1985-86 and stayed near this level in 1986-87.



## PROVISIONS OF THE CANADA WATER ACT

Part I of the Act provides for the establishment of federal-provincial consultative arrangements for water resource matters (Section 3); and for cooperative agreements with the provinces for the development and implementation of plans for the management of water resources (Section 4 - 7). This part also enables the Minister, directly, or in cooperation with any provincial government, institution, or person, to conduct research, collect data, and establish inventories associated with the water resources.

Part II envisages federal-provincial management where water quality has become a matter of urgent national concern. This part permits the establishment of joint federal-provincial incorporated agencies (although existing federal and provincial corporations might alternatively be used) to plan and implement approved water quality management programs.

Part III of the Act provides for regulations banning the manufacture or import for use or sale in Canada of any cleaning agent or water conditioner that contains a nutrient in a greater concentration than that prescribed by regulations. This is one of the principal means of reducing the rate of eutrophication of water bodies. It is planned to transfer this part of the Act to the new Canadian Environmental Protection Act.

Under Part IV are provisions for the general administration of the Act. In addition, it provides for inspection and enforcement, allows the Minister to establish Advisory Committees and permits the Minister, either directly or in cooperation with any government, institution, or person, to undertake public information programs.

## ACTIVITIES UNDER THE CANADA WATER ACT

### Inquiry on Federal Water Policy

In January 1984, a three-member Advisory Committee was appointed by the Environment Canada Minister under section 26 of the Canada Water Act in response to a growing environmental consciousness and concern about the management of Canada's freshwater resources. Some of the emerging issues which prompted the Inquiry are growing water supply/demand imbalances in the Prairie Provinces, the related question of climate change and its effect on the water resources, and growing interest in southward diversions; increasing public interest in the water export controversy; and the rapid proliferation of toxic substances in the environment leading to a perceived loss of confidence amongst Canadians about the quality of the drinking water.

Under its terms of reference, the Inquiry was required to assess the adequacy of federal water policy and the capacity of federal institutions to respond to changing circumstances. In particular, consideration was to be given to the nature of emerging issues, the state of the resource, future requirements for water, interjurisdictional matters, and scientific and research expertise. The views of as many Canadian as possible were to be sought.

In the fall of 1984, the Inquiry held public hearings at seventeen locations across Canada, and received over 300 written submissions from individuals and organizations. Numerous federal, provincial and territorial officials were consulted to ensure a broad range of facts, viewpoints and advice. In addition, studies and research projects on special problems were commissioned.

The Inquiry's final report "Currents of Change" was published in September 1985 to respond to the terms of references and to promote understanding and heighten awareness of the problems and opportunities in water management. Informative reports were also published for the 22 special research projects commissioned.

Immediately following release of the Inquiry's final report on September 30, 1985, the Minister established an Interdepartmental Water Policy Task Force to advise him on the Inquiry's recommendations, and to develop the framework for a Federal Water Policy.

Provincial Ministers discussed the Inquiry's final report at a meeting of the Canadian Council of Resource Ministers in October 1985 and again in October 1986, while a similar meeting for non-government organizations was held in November 1985 in conjunction with Environment Canada's annual public consultations.

The Task Force reported to the Environment Minister, and that report was released in March 1987. The report responded to the Inquiry's recommendations and providing advice on the scope and nature of an appropriate federal water policy. Enunciation of a federal water policy was continuing at year's end.

### Great Lakes Water Levels Communication Centre

Excessive inflows raised Great Lakes levels to record high proportions in 1986-87 and posed a serious threat to lakeshore facilities, especially during periods of high winds. To meet this problem, Environment Canada established the Great Lakes Water Levels Communication Centre at the Canada Centre for Inland Waters in Burlington. It has become the nerve centre for all federal activities and programs related to flooding on the Great Lakes. The Centre is designed to gather and coordinate all relevant information from all federal departments and it is in contact with other government agencies, including some in the United States; the Centre rapidly analyses and disseminates the data as quickly as possible for use by governments, planners, and individual citizens alike.

During the year, the Centre responded to over 1100 telephone inquiries from the general public and media. As well, it operated around the clock during more than 50 high water level events to monitor these events and provide up-to-the-minute information to callers. The Centre also launched a comprehensive communications strategy, which involved the publication and distribution of an eight-page newspaper insert entitled "Living with the Great Lakes", and the production and distribution of a 14-minute film called "Lakeviews: Perspectives on Great Lakes Water Levels". This strategy also included offers of information briefings and open houses to some 270 Great Lakes municipalities.

In addition to disseminating information, the Water Level Communications Centre has also gathered information for its existing database on the effects of flood and erosion damage. This activity included a survey of erosion of selected locations in the nearshore zones along the Great Lakes. In addition, aerial photography of the Canadian shoreline of Lakes Superior and Ontario was completed for use in the preparation of flood risk maps.

## PART I: Comprehensive Water Resource Management

### Federal-Provincial Cooperation

The Canada Water Act calls for joint consultation between the federal and provincial governments in matters related to water resources. Discussed briefly in the following are joint programs under the national Flood Damage Reduction Program as well as other projects involving the regulation, apportionment, monitoring or survey of water resources, and the preplanning, planning or implementation of Water Management Programs.

Agreements for specific water programs provide for the participating governments to contribute funding, information, and expertise in agreed ratios. For ongoing activities such as the water quantity survey agreements with each province, cost sharing is in accordance with each party's need for the data. For study and planning agreements, it is usual for the federal government to meet half the costs and the provincial government(s) the other half. The planning studies encompass interprovincial, international or other basins where federal interests are important. Cost sharing for implementation is in proportion to federal and provincial responsibilities and often includes a contribution from local governments.

### Interdepartmental Committee on Water

The Interdepartmental Committee on Water (ICW) was established in 1968 to promote coordination and to advise on all federal water programs. Since then, ICW has actively pursued its mandate and, in March 1986 held the 57th meeting since its inception. At year's end, the Committee was reviewing its terms of reference and mode of operation in response to the recommendations of the Inquiry on Federal Water Policy and the Interdepartmental Water Policy Task Force.

A total of 21 departments and agencies with an interest in water matters are represented on this 25-member committee. Subcommittees and Working Groups are set up as required. Currently there are six subcommittees whose areas of interest are 1) the Canada-U.S., and Canada-Ontario Great Lakes Water Quality Agreements, 2) water quality, 3) floods, 4) the preparation of responses to IJC reports, and 5) the coordination of federal activities in the Mackenzie River basin.

In addition to the work of these subcommittees, issues or subjects of interest brought to the attention of ICW over the past year included: activities related to the development of a Federal Water Policy, municipal infrastructure, water export, the National Marine Parks Policy, the Canada/Ontario response to the IJC's third biennial report and the Canada/Saskatchewan Subsidiary Agreement on Irrigation-Based Economic Development.

### Federal-Provincial Water Resource Management Programs

Table 1 shows a breakdown of current cost-shared federal-provincial water management programs and indicates the stage each has reached. Each of the programs is referred to briefly in the following few pages and described in more detail later in this report. Table 2 is a record of the achievements under the Act since its inception in 1970.

Regulation, Apportionment, Monitoring and Survey Programs: Although most federal-provincial agreements carry a time limit within which the objectives of the agreement are likely to be reached, there are some agreements involving monitoring and survey responsibilities which are projected to continue into the foreseeable future without termination.

The federal government has been involved in the collection of water quantity data since the late 1800s. In earlier years, hydrometric networks were operated under informal arrangements with all provinces except Quebec. The 1922 agreement with Quebec was rescinded in 1964 when the Quebec government took responsibility for most of the hydrometric network in that province. Beginning in April 1975, uniform cost-sharing Water Quantity Survey Agreements were implemented with all provinces and Memoranda of Agreement with the Department of Indian and Northern Affairs for the territories. These agreements recognize that water quantity data may be collected to meet federal interests, provincial interests, or a combination of both. Hence funding for the operation of the networks is provided according to each party's needs. The water quantity networks and cost-sharing data are determined annually by Federal-Provincial Coordinating Committees. Also, a national meeting of all Federal-Provincial Coordinating Committees is convened periodically to review annual progress reports and to discuss any concerns arising under the Agreements. During the year, a total of 3000 gauging stations were operated under the Agreements in Canada, 2688 by the federal government and 312 by the Province of Quebec. Data from these stations as well as from 398 stations operated mainly by other provincial agencies are contained in the national water data bank - HYDAT; the data bank also contains data for another 3915 discontinued stations. Under the terms of the Agreements, Canada is responsible for maintaining the computer database and for publishing the data. Water quantity data are essential to good water management and, since the costs of collecting water data are substantial, the efficiency of data collection programs is enhanced significantly by planning networks and using standardized methodology. To ensure that the data provided to the user is of the highest quality and precision, a quality assurance program is being implemented to monitor methods and procedures in field surveys and office automated computations to established national standards.

In a move to improve upon data collection associated with the hydrometric survey, a five-year program to acquire and install data collection platforms (DCPs) at remote hydrometric sites across Canada received Treasury Board approval effective April 1, 1983. Through the use of satellites, the DCP permits the real-time acquisition of hydrometric data. Effectiveness of operation and cost savings were key items in the original proposal, with the output of greatest value to navigation, reservoir operation, water allocation, flood forecasting and similar purposes. When necessary, DCPs are being equipped with sensors to provide information required by the Atmospheric Environment Service and the Canadian Forestry Service. As of March 31, 1987, 314 active DCPs were in operation; by the end of 1987, the active total is expected to grow to about 400.

TABLE 1 - STATUS OF FEDERAL AND FEDERAL-PROVINCIAL WATER MANAGEMENT PROGRAMS

REGULATION, APPORTIONMENT, MONITORING AND SURVEY PROGRAMS

<u>Under Negotiation</u>	<u>New During 1986-87</u>	<u>Ongoing During 1986-87</u>
Water Quality Monitoring Agreements with Saskatchewan, Prince Edward Island, Manitoba, New Brunswick, Ontario, Northwest Territories and Yukon	Water Quality Monitoring Agreement with Newfoundland	Water Quantity Surveys with all provinces Prairie Provinces Water Board Mackenzie River Basin Committee Water Quality Monitoring Agreement with Quebec and British Columbia Lake of the Woods Control Board* Ottawa River Regulation Planning Board Ottawa River Water Quality Coordinating Committee

WATER MANAGEMENT PROGRAMS

<u>Under Negotiation</u>	<u>New During 1986-87</u>	<u>Ongoing During 1986-87</u>
Water Management for Economic Development in Prince Edward Island Yukon Implementation	South Saskatchewan River Basin Study Saskatchewan Irrigation Development**	Mercury in Churchill River Diversion System Lower Fraser Valley Flood Control Canada-Ontario Agreement on Great Lakes Water Quality Qu'Appelle Conveyance Regina - Moose Jaw Water Treatment Plant** Channel - Port aux Basques Water Improvements** Fraser River Estuary Management Program Implementation

FLOOD DAMAGE REDUCTION PROGRAM

<u>Under Negotiation</u>	<u>New During 1986-87</u>	<u>Ongoing During 1986-87</u>
Initial Agreements with Alberta, British Columbia and Yukon Territory Amending Agreements with Northwest Territories, Quebec and New Brunswick Manitoba Flood Forecasting	Amending Agreements with Saskatchewan	Mille Iles Control Structure Montreal Region Agreement for Flood Control on the Saint-François River in Richmond Amending Agreements with Newfoundland, Nova Scotia, New Brunswick, Ontario and Manitoba Memorandum of Understanding Indian Lands Manitoba Flood Protection Projects

\* Established under the Lake of the Woods Control Board Act.

\*\* Not a Canada Water Act Agreement but included here in the interest of completeness.  
Special funds were made available for this project under Economic and Regional  
Development Sub-Agreements.

TABLE 2 - PROGRAMS OR STUDIES COMPLETED UNDER THE CANADA WATER ACT

Peace-Athabasca Delta Planning	1972
Qu'Appelle River Basin Planning	1972
Saskatchewan-Nelson Basin Planning	1973
Okanagan Basin Planning	1974
Saint John Basin Planning	1975
Lake Winnipeg, Churchill and Nelson Rivers Planning	1975
Great Lakes Shore Damage Survey	1975
Fraser River Upstream Storage Planning	1976
Churchill River Basin Planning (Sask.-Man.)	1976
Montreal Region Flow Regulation Planning	1976
Peace-Athabasca Delta Implementation	1976
Northern Ontario Water Resources Planning	1978
Southeastern New Brunswick Dyking Implementation	1978
St. Lawrence Water Quality Planning	1978
Souris Basin Planning	1978
Metropolitan Toronto Flood Control Implementation	1978
Lower Saskatchewan Basin Preplanning	1979
Southwestern Ontario Dyking Implementation	1979
Upper Thames Flood Control Implementation	1979
Yukon Basin Preplanning	1979
Ottawa River Regulation Planning Report	1980
Thompson Basin Preplanning	1981
Great Lakes Shore Damage Survey Implementation	1981
Dykes and Flow Regulation Works - Montreal Region	1981
Mackenzie Basin Planning	1982
Shubenacadie-Stewiacke Basin Planning	1982
Ottawa River Water Quality Report	1982
Okanagan Basin Implementation	1982
Prairie Provinces Water Board's Water Demand Study	1983
North Shore (St. Lawrence) Ecological Inventories	1983
Winter River Preplanning	1983
Qu'Appelle Basin Implementation	1984
Wabigoon-English Mercury Contamination Study	1984
Flood Prevention Within the City of Quebec	1984
Fraser River Estuary Planning	1984
Studies and Implementation of Dykes and Flow Regulation Works - Montreal Region	1984
Waterford Urban Hydrology Study	1985
Yukon River Basin Planning	1986
Northern Manitoba Mercury Study	1986
Winter River Basin Planning	1987

Currently, data from the DCP network are being retrieved from a U.S. receive station via an automatic dial-up system. The establishment of ground receive stations in Canada is being investigated. Installation of these facilities will greatly improve the efficiency of distributing real time data required for network operations.

Environment Canada has been negotiating water quality monitoring agreements with interested provinces to provide for sharing of costs, exchange of data and a Canada-wide quality control program. To date, agreements have been signed with Quebec, British Columbia and Newfoundland; an agreement with Alberta has been postponed; negotiations for agreements with Manitoba, Saskatchewan, New Brunswick, Ontario and Prince Edward Island are progressing; negotiations have begun with Yukon and the Northwest Territories, and are scheduled to begin with Nova Scotia in 1987. If all provinces join the program, the new network is expected to incorporate 450 existing stations of federal interest, upwards of 2000 existing stations of provincial interest, and about 180 new stations of joint interest. In addition, some agreements may include cost-shared surveys or special studies to best address existing or emerging issues of joint concern. The proposed stations exclude Great Lakes water quality stations which are administered under other agreements. In March 1983, Treasury Board approved the resources required to implement the agreements.

The Prairie Provinces Water Board, a federal-provincial board which administers the Prairie Provinces Master Agreement on Apportionment, continued to provide recommendations to Canada, Alberta, Saskatchewan, and Manitoba concerning the equitable apportionment of eastward flowing interprovincial prairie rivers. During the year, the Board's Committees on Hydrology, Water Quality and Groundwater continued to recommend procedures for natural flow determination for apportionment purposes and for evaluating the effect that proposed projects might have on the balance of interprovincial waters. A four-year study of historic and current water demands in the three prairie provinces was completed in February 1983 and that information is now being updated on a continuous basis. The Board also has approved the report on Administration of the Apportionment Agreement and has implemented the recommendations on apportionment of the flow of Battle, Lodge and Middle Creeks at the Alberta-Saskatchewan boundary.

The Mackenzie River Basin Committee, with representation from Canada, Alberta, Saskatchewan, British Columbia and Yukon and Northwest Territories, met during the year to fulfill its liaison responsibilities and to consider study designs, budgets and agreements associated with implementation of Recommendations 2 and 5 contained in the Mackenzie River Basin Study Report of 1982. The Committee also is considering a general agreement which will supersede the 1977 Memorandum of Understanding which formed the Committee; the new agreement would reconstitute the Committee, and give full member status to the Northwest Territories and Yukon Territory.

The Ottawa River Regulation Planning Board has a mandate to plan and recommend criteria for regulating the Ottawa River, taking into account hydro-power production, flood protection, navigation, low water problems, water quality needs and recreation. Studies were under way to



develop risk management methodology for the Ottawa River basin and to assess the impacts of using flood reserves for the operation of the Mille Iles dam.

The Ottawa River Water Quality Coordinating Committee was established early in 1983 to be responsible for reviewing data needs and for coordinating data collection through a joint monitoring program. The Board's first annual report, which was released during the year, contained an analysis of monitoring data from the past several years. The report noted some improvement in water quality in the river.

In support of the international Garrison Technical Committee, the Fisheries and Biota, and Engineering Task Forces reviewed the Canadian concerns with regard to the U.S. Bureau of Reclamation reports entitled "Draft Supplement to the Draft Supplemental Environmental Statement Reformulated Plan - Garrison Diversion Unit - North Dakota" and the "Draft Supplemental Environmental Statement Reformulated Plan - Garrison Diversion Unit - North Dakota". The International Consultative Group from External Affairs and the State Department will be using this information in their continuing Canada-United States dialogue on the Garrison irrigation project.

The Lake of the Woods Control Board continued to regulate certain waterways in the Winnipeg River basin so as to balance the requirements of the various and sometimes conflicting interests that depend upon the water in the basin. The Board was established under the Lake of the Woods Control Board Act, well before the Canada Water Act was passed, and is described here only to complete the picture on federal-provincial water management in Canada.

Water Management Programs: Depending upon the nature of the work being conducted, water management programs can fall within any of the three stages - preplanning studies, planning studies or implementation activities. During 1986-87, several water management programs were continued, and a framework plan was initiated to guide resource development in the Saskatchewan portion of the Saskatchewan River basin.

Preplanning Studies: Preplanning studies normally arise as a result of public representation to resolve one or more problems which are perceived at the local level. The preplanning study has become the vehicle with which to investigate the concerns expressed, and also to examine briefly all of the emerging and potential opportunities and problems of the area in question and to make recommendations as to the desirability of a longer-term planning study. Although there were no formal preplanning studies under way in 1986-87, a work sharing arrangement between Environment Canada and the Prince Edward Island Department of Community and Cultural Affairs was negotiated respecting the conduct of Studies on Water Resources Management For Economic Development. This is a three-year project coordinated by a federal-provincial committee with each party contributing \$500 000 worth of work. The studies include special surveys and demonstration projects related to ground water resources, inland surface water resources, estuarine water resources, and multi-sectoral and integrated water management.

Planning Studies: Planning studies generally are directed towards the development or management of the water resources for the social betterment and economic growth of the basin or area under study. In May 1986, the Canada-Saskatchewan River Basin Study Agreement was signed to develop a framework plan to guide future water development in the basin. The plan will assess the impacts of future growth, and ensure that the basin's limited supplies of water can meet the needs of the range of uses. A final report is scheduled for December 1989 and is timely given 1) the recent completion of Alberta's South Saskatchewan Study and follow-up Water Resources Commission Report which considered water resources planning and development options for the upstream part of the basin in Alberta and 2) the signing in October 1986 of a five-year Agriculture Canada-Saskatchewan Water Corporation Irrigation Development Agreement which will add considerably to water demands in the basin. (The latter agreement is described at the end of this report.)

In its final study report released on March 26, 1986, the Yukon River Basin Committee's main recommendation was that a formal agreement be established to develop a framework for water resource planning and coordinate ongoing water planning and management activities in the Yukon River basin. During 1986-87, a working group met to review the status of water and related resource activities in the basin and to prepare an intergovernmental agreement by March 31, 1988 for implementing the study recommendations.

Canada, Manitoba, Manitoba Hydro and the Northern Flood Committee, which comprises the five Indian Bands of Cross Lake, Nelson House, Norway House, Split Lake and York Landing, signed the Northern Flood Agreement in December 1977. This Agreement, which is not under the Canada Water Act, is administered federally by the Department of Indian and Northern Affairs to provide compensation for the effects of Nelson River hydro-power developments, specifically Lake Winnipeg regulation and the Churchill River diversion. It also provides an opportunity for renewed economic and social development in the communities. Article 17 of the Agreement commits Canada, Manitoba, and Manitoba Hydro 1) to joint action for the implementation of the recommendations of the Lake Winnipeg, Churchill and Nelson Rivers Study Board Report which deals with ecological concerns and 2) to report annually to the Band Councils on progress made. In April 1986, Treasury Board approved \$1.76 million for Environment Canada to design and implement a 5-year ecological monitoring program. During fiscal year 1986-87, an annotated bibliography containing approximately 380 references related to Lake Winnipeg Regulation and Churchill River Diversion was completed. Discussions on the direction and focus of the Environment Canada program were held with the Northern Flood Committee, Fisheries and Oceans Canada, the Government of Manitoba, and Manitoba Hydro. Following this consultation process, long-term studies on water quality and quantity, sediments and sediment transport, and waterfowl populations were initiated.

Implementation Programs: Although no new implementation agreements were initiated in 1986-87, several programs continued owing to agreements in earlier years, including a renewed Canada-Ontario Agreement on Great Lakes Water Quality which extends to March 31, 1990. This agreement provides

for the cost-sharing of surveillance, upgraded sewage treatment and phosphorus control and reflects the commitments undertaken by Canada in the 1978 Canada-U.S. Great Lakes Water Quality Agreement. It also re-emphasizes the cooperative phosphorus control and Great Lakes surveillance programs and, in accordance with the 1978 agreement, outlines programs for dealing with toxic substances and hazardous materials in the Great Lakes. On October 16, 1983, Canada and the United States signed a supplement to the 1978 Agreement for the purpose of lowering phosphate levels in Great Lakes waters.

An Agreement Respecting a Fraser River Estuary Program was signed in October 1985 by Environment Canada, the Department of Environment for British Columbia, Fisheries and Oceans Canada, the Fraser River Harbour Commission and the North Fraser Harbour Commission. To cost \$1 250 000 over five years, the Program is based on a study conducted between 1977 and 1982. Well into its second year of operation, the Program is designed to guide economic development while protecting the environment of the Estuary.

To improve the water of the Town of Channel-Port aux Basques, the Newfoundland and federal governments signed an ERDA Sub-Agreement on July 31, 1985, under which the federal government will provide a maximum of \$6.5 million or 90% of costs (whichever is less) towards the \$7.222 million agreement. Work was under way on the fabrication of a modular package treatment unit during 1986-87.

To complete the conveyance work begun under the 1974-1984 Qu'Appelle Implementation Agreement, the Qu'Appelle Conveyance Agreement was signed by Canada and Saskatchewan in June 1984. Extending to March 31, 1989, the \$4.75 million Agreement is cost-shared equally by the two governments. The program is designed to improve the channel carrying capacity in restricted areas of the river. When completed, the improved channel will convey larger quantities of water with less overbank flooding. During 1986-87, channel improvements were made on the Muscowpetung and Piapot Indian reserves.

To improve the water supply to Regina and Moose Jaw, the Saskatchewan and federal governments signed an ERDA Sub-Agreement on May 1, 1984, under which the federal government provided \$5 million towards the \$15 million cost for a granular activated carbon water treatment facility. The plant was officially commissioned in June 1985 and has now completed its second summer of operation. During a two-week period in August 1986 there were unexpected taste and odor problems. The causes of the problems were partly owing to the early start of operations in 1986 and the higher than usual algae load. Experience gained is being used in an initial design proposal to double the capacity of the existing water treatment plant. Environment Canada has provided an observer for the selection of the engineering consultant and preliminary design meetings that were held by the cities of Regina and Moose Jaw during the year.

The Canada-British Columbia Lower Fraser Valley Flood Control program, designed to reduce damages due to floods in the lower Fraser Valley of British Columbia, continued during the year. Some \$124 million of a total joint commitment of \$161 million was spent to the end of March 1987.

Flood Damage Reduction (FDR) Program: During 1986-87, this program was active throughout most of Canada.

**OBJECTIVE:** The Flood Damage Reduction Program follows the cooperative federal-provincial approach of the Canada Water Act. Its overall aim is to reduce flood damages. The first step is to identify flood risk areas and discourage further flood vulnerable developments in those areas. Where existing development warrants it, a second step may be to provide remedial measures.

When joining the program, the provinces sign a General Agreement and a Mapping Agreement (or a combined agreement). The General Agreement outlines the basic approach that will be taken to reduce flood damages. The respective governments and their agencies agree not to engage in, or provide assistance to undertakings vulnerable to flood damage in designated flood risk areas. In such areas, federal disaster assistance will be restricted to structures built before designation and, in some circumstances, new structures which are flood-proofed. Zoning on the basis of the flood risk is encouraged.

The Mapping Agreement provides for the flood risk mapping and designation of the areas to which the policies in the General Agreement will apply. Forming part of this agreement is a list of communities in the province which are to be mapped and specifications to be followed in conducting the hydrotechnical and mapping work. When maps not meeting these specifications are available, interim designation may be applied until such time as new maps are prepared. This agreement also requires that information pertaining to the designated area be made available to governments, zoning authorities, the public and anyone contemplating development in or near these areas. As a matter of course all flood risk maps and reports are distributed to key federal departments represented on the Treasury Board Advisory Committee on Federal Land Management and to a number of federal departments whose programs could be affected by FDR Program designations. Designations to March 31, 1987 are listed in Table 3.

In some cases existing developments in designated areas will still require protection against flood damages and, for this reason, further agreements to study such problems can also be negotiated with the provinces. Where benefits exceed costs and where there is a national interest, federal-provincial agreements may subsequently be reached on implementation action. This action could include flood forecasting and warning, flood proofing, works to control flows and levels, acquisition of property, easements or land use planning. It should be noted that, in examining alternatives, the best choice will be made on the basis of effectiveness, cost, and environmental impact. This could mean allowing some flooding to occur.

**DURATION:** The original agreements generally covered a ten-year period, but an Amending Agreement in 1980-81 extended the General Agreement with Manitoba beyond the ten-year period. Similar extensions occurred in 1981-82 with the signing of an Amending Agreement with New Brunswick and in 1982-83 with the signing of an Amending Agreement with Ontario. In 1983-84 the General and

Mapping Agreements with Newfoundland, the Mapping Agreement with Quebec and the Flood Forecasting Agreement with Manitoba were amended. In 1984-85 the General, Mapping, and Studies Agreements with Nova Scotia were amended. In 1985-86 the Mapping Agreement with Ontario and the General, Mapping, Studies, and Ring Dyke Upgrading (now Construction of Flood Protection Projects) Agreements with Manitoba were amended. In 1986-87, the General Agreement with Saskatchewan was amended while new Mapping, Studies and Community Flood Plain Management Measures Agreements with Saskatchewan were signed. Proposed amendments are discussed in following sections.

**PARTICIPANTS AND FUNDING:** Canada and the provinces share the costs (see Table 4).

**RELATED AGREEMENTS:** Several ongoing studies and implementation agreements dealing with flood prone areas in Canada were in force when the Flood Damage Reduction Program was launched. Only one such agreement remains as described elsewhere in this report under the title: Lower Fraser Valley Flood Control.

#### REPORT ON PROGRESS

##### Newfoundland

The community of Rushoon was designated on February 28, 1987, raising to six the number of designations in Newfoundland. Remedial measures studies have been completed for Steady Brook, Placentia, Badger and Rushoon.

Hydrotechnical work is under way towards designation of areas along Deer Lake, along the Waterford River and in the Stephenville Crossing/Black Duck area. Base maps have been completed for Stephenville Crossing/Black Duck, Waterford, Cox's Cove and Parson's Pond. Terms of Reference are under preparation for Cox's Cove and Parson's Pond hydrotechnical studies.

A regional Flood Frequency Analysis was completed for the island of Newfoundland in 1984; a user's summary report was completed in 1986.

Discussions have taken place towards the establishment of a flood forecasting arrangement.

##### Nova Scotia

The Little Sackville River hydrotechnical study and working maps have been completed and the public relations maps are nearing completion. Designation is expected in May 1987.

The Truro hydrotechnical study was completed and work has commenced on floodline plotting.

Base maps have been completed and some field work has been undertaken of the Kentville area. A remedial study had previously been completed of the Mill Brook area of Kentville.

TABLE 3 - DESIGNATIONS TO MARCH 31, 1986 UNDER THE FLOOD DAMAGE REDUCTION PROGRAM

<u>LOCATION</u>	<u>NUMBER OF COMMUNITIES MAPPED</u>	<u>NUMBER OF PUBLIC INFO. MAPS</u>	<u>POPULATION<sup>1</sup></u>	<u>DATE OF DESIGNATION</u>
<u>NEWFOUNDLAND</u>				
Stephenville*	2	1	9 000	June 84
Steady Brook*	2	1	570	Mar. 85
Placentia*	2	1	2 840	Mar. 86
Badger	1	1	1 090	Mar. 86
Rushy Pond	1	1	20	Mar. 86
Rushoon	-	-	-	Feb. 87
6 designations	8	5	13 520	
<u>NOVA SCOTIA</u>				
East River*	5	1	16 900	Feb. 84
Sackville River*	3	1	7 100	Feb. 84
Antigonish*	2	1	23 300	Nov. 84
3 designations	10	3	47 300	
<u>NEW BRUNSWICK</u>				
Fredericton*	10	1	65 000	Feb. 80
Perth/Andover	2	1	1 900	Feb. 80
Oromocto to Lower Jemseg*	16	1	15 000	Mar. 81
Lower Fredericton to Lincoln*	3	1	3 000	Feb. 82
Sussex*	15	1	5 000	Sept. 82
Keswick*	5	1	1 100	Mar. 83
Norton	2	1	1 700	May 85
Walker Brook*	2	1	1 500	Mar. 86
8 designations	51	6	91 000	
<u>QUEBEC</u>				
Montréal Region*	38	22	1 940 000	May 78
Chaudière Basin*	19	8	50 000	Mar. 79
Gatineau/Ottawa Rivers*	19	15	283 000	Oct. 79
Upper Richelieu River*	19	11	80 000	Apr. 80
du Gouffre*	4	2	9 000	Apr. 80
Lower Richelieu River*	23	10	125 000	Nov. 81
Rivière Assomption*	12	4	94 000	May 82
Rivière Saint-François*	14	6	170 000	Oct. 82
Rivière Yamaska*	22	12	64 000	June 83
Rivière Bécancour*	4	2	14 000	May 84
Rivière Nicolet Basin*	10	3	73 000	May 84
Trois-Rivières-Ouest	1	5	13 000	Aug. 84
12 designations	185	100	2 915 000	

Table 3 (cont'd)

<u>LOCATION</u>	<u>NUMBER OF COMMUNITIES MAPPED</u>	<u>NUMBER OF PUBLIC INFO. MAPS</u>	<u>POPULATION<sup>1</sup></u>	<u>DATE OF DESIGNATION</u>
<u>ONTARIO</u>				
White River	1	1	1 000	Aug. 82
Toronto*	24	8	3 000 000	Dec. 82
Sturgeon River/Lake Nipissing/ French River*	9	5	63 000	Mar. 83
Kaministiquia River*	2	1	39 000	Aug. 83
Nipigon	1	1	2 400	Mar. 86
Atikokan	1	1	4 400	Mar. 86
Grand River	-	-	-	Mar. 87
Maitland Valley	-	-	-	Mar. 87
Nickel District	-	-	-	Mar. 87
Otonabee Region	-	-	-	Mar. 87
Lower Trent Region	-	-	-	Mar. 87
11 designations	38	17	3 109 800	
<u>MANITOBA</u>				
Melita	1	1	1 200	Dec. 79
Wawanesa	1	1	500	Dec. 79
Winnipeg	1	1	565 000	Feb. 80
Souris	1	1	1 750	Oct. 80
Elie	1	1	450	Nov. 80
Brandon	1	1	36 250	Mar. 82
La Salle - Sanford - Starbuck	3	1	975	Nov. 82
Swan River	1	1	3 800	May 83
Dauphin	1	1	9 000	Feb. 84
Carman	1	1	2 400	June 84
Lorette	1	1	1 100	Sept. 84
13 designations	13	11	622 425	
<u>SASKATCHEWAN</u>				
Estevan	1	1	9 200	Aug. 80
Oxbow	1	1	1 200	Aug. 80
Roche Percée	1	1	150	Aug. 80
Moose Jaw	1	1	34 000	Oct. 81
4 designations	4	4	44 550	
<u>NORTHWEST TERRITORIES</u>				
Hay River*	2	1	2 900	May 84
Fort Simpson	1	1	980	June 85
Aklavik	1	1	720	June 85
Fort McPherson	1	1	630	June 85
Fort Good Hope	1	1	460	June 85
5 designations	6	5	5 690	
56 designations	319	153	6 852 485	

1. Figures are approximate and based on 1981 Census data.

Table 4 - FEDERAL-PROVINCIAL FLOOD DAMAGE REDUCTION AGREEMENTS TO MARCH 31, 1986

	<u>Duration</u> <u>(years)</u>	<u>Total Cost*</u> <u>(dollars)</u>	<u>Expiry</u> <u>Date</u>
<u>NEWFOUNDLAND</u>			
Amending Agreement	-	-	-
General Agreement	12	-	1993
Flood Risk Mapping Agreement	7	1 470 000	1988
Studies Agreement	5	480 000	1988
<u>NOVA SCOTIA</u>			
Amending Agreement	-	-	-
General Agreement	16	-	1994
Flood Risk Mapping Agreement	11	1 030 000	1989
Studies Agreement	11	670 000	1989
<u>NEW BRUNSWICK</u>			
Amending Agreement	-	-	-
General Agreement	15	-	1991
Flood Risk Mapping Agreement	10	2 000 000	1986
Studies Agreement	10	200 000	1986
Flood Forecasting Agreement - Saint John River Basin	10	1 400 000	1987
Flood Damage Reduction - Marsh Creek	6.5	2 010 000(a)	1984
Petitcodiac Sea Dykes Agreement	3 months	160 000	1979
<u>QUEBEC</u>			
Amending Agreement	-	-	-
Combined General and Flood Risk Mapping Agreement	16 (mapping 11)	6 000 000	1992
Dykes and Flow Regulation Works - Montreal Region	7.5	16 056 000(b)	1984
Quebec City Flood Prevention Agreement	2	833 000(b)	1985
Mille Iles River Agreement	3.5	13 100 000(b)	1987
Saint Francois River Agreement - Town of Richmond	3	4 350 000(b)	1987
<u>ONTARIO</u>			
Amending Agreement	-	-	-
All Inclusive Flood Damage Reduction Agreement	17 (mapping 12) (other 14)	- 15 400 000 2 200 000	1995 1990 1992
<u>MANITOBA</u>			
Amending Agreement	-	-	-
General Agreement	17	-	1994
Flood Risk Mapping Agreement	11	2 350 000	1988
Studies Agreement	12	310 000	1989
Flood Forecasting	8.5	1 000 000	1989
Construction of Flood Protection Projects Agreement	7	6 100 000(b)	1989
<u>SASKATCHEWAN</u>			
General Agreement	20	-	1997
Flood Hazard Mapping and Studies Agreement	(mapping 5) (studies 5)	1 300 000 480 000	1982 1982
Flood Hazard Mapping and Studies	(mapping 5) (studies 5)	750 000 250 000	1992 1992
Community Floodplain Management Measures	5	580 000	1992
<u>NORTHWEST TERRITORIES</u>			
Memorandum of Understanding	2	225 000(c)	1978
Memorandum of Understanding	10 (mapping 5)	400 000(c)	1989 1984
General Agreement	10	-	1989

\* These costs are to be shared equally by the federal and provincial governments except for:  
(a) 33-1/3% federal, 66-2/3% provincial/local; (b) 45% federal, 55% provincial/local; (c) costs  
shared equally by Environment Canada and the Department of Indian and Northern Affairs



## New Brunswick

The Mapping and Studies Agreements expired on March 31, 1986 and the Flood Forecasting Agreement, on March 31, 1987. At year's end, draft agreements were proposed that would amend the General Agreement and produce a combined Studies and Mapping Agreement. Federal support for the Saint John River Flood Forecasting Centre will be phased out over the next five years.

Except for localized flooding caused by ice jams, peak water levels along the Saint John River were below flood stage in 1986. Above normal snowpack and ice conditions were reported in March 1987, especially in southern New Brunswick.

## Quebec

Work under the Canada-Quebec Agreement respecting flood damage reduction on the Saint-François River within the limits of the Town of Richmond was completed at a total cost of \$3.7 million, of which the federal share was \$1.7 million. A project to protect the section north of the town has been proposed. These works, however, were not forecast in the original agreement and, because of budget uncertainties, Environment Canada was unable to agree to proceed with additional works.

Under the Agreement respecting flood damage reduction on the Mille Îles River, construction of the flood control structure was completed in December 1985. The structure is operational, but work on the automated control system was ongoing in 1986. The Ministers agreed through an exchange of letters concluded on August 15, 1985 to reallocate funds contained in the Agreement to increase funding for studies from \$30 000 to \$230 000; these funds are being used to undertake studies for improving the possibilities of operating the control structure by improving regulation of some reservoirs on the Ottawa River. At Quebec's request, Treasury Board has been asked to extend the Agreement to March 31, 1988, to permit implementation of works to raise a section of a street bordering the river downstream of the control structure in the City of Laval.

Negotiations to amend the Mapping Agreement are complete and have been approved by Treasury Board. The proposed amendments will allow the mapping portion of the Agreement to continue until March 31, 1992 with additional funding of \$4.8 million, and the termination date of the Agreement in terms of policies would be March 31, 1997. The number of communities to be mapped, listed in Annexe 'A', is expected to be increased considerably. A derogation procedure for special cases such as specific requests for public works and requests made by third parties are included in the negotiated agreement. The flood zones along the Saint-François River in the City of Richmond were redesignated on March 17, 1987 to take into account dyking undertaken within that community.

To date twelve designations have occurred under the agreement, affecting 185 municipalities.

## Ontario

The Canada/Ontario FDR Program funded 21 new projects during the year. Of these, 17 projects were for flood risk mapping. A major achievement in project planning and administration was the placement of much revised and upgraded terms of reference for carrying out flood risk mapping projects.

The Steering Committee recommended and the Ministers agreed to designate the flood risk areas on a Conservation Authority-wide basis in Lower Trent River Conservation Authority and Nickel District Conservation Authority and on a community-wide basis in Grand River Conservation Authority and Otonabee Region Conservation Authority; Lake Huron shoreline within the jurisdiction of Maitland Valley Conservation Authority was also designated.

To date, in excess of 100 streams and communities have been mapped under the Program. Currently, work is in progress on behalf of 20 Conservation Authorities and 17 municipalities where no Conservation Authority exists.

The Steering Committee initiated two regional hydrology studies in Nottawasaga Valley Conservation Authority and Muskoka River watershed. This area-wide hydrology study provides design flows for floodline mapping and five locations in Nottawasaga and three in Muskoka. All future mapping will incorporate the flows generated from these studies.

A seminar based on the findings of the Depth of Flooding Damage Curve Development Study was presented to users within and outside of the department. The objective of the study was to develop a set of curves that will relate the depth of flooding to the damages sustained by housing. A number of ongoing studies are using the findings.

Two projects studying the alternatives of flood proofing of existing developments in the flood risk areas of the Goulais River and the improvement of reservoir operations in Halton Region Conservation Authority with the objective of reducing damage in the downstream communities were completed. Work was in progress and due for completion in 1987 for other flood damage reduction measures on a number of streams in Niagara Peninsula Conservation Authority. The policy development guideline study for delineating floodway and flood fringe was completed. The project is addressing various topographic, social, technical, cultural and political constraints imposed in properly assessing the floodway/flood fringe concepts.

All three volumes of the Regional Flood Frequency Analysis for Ontario Streams were published. Volume 1 of the report addressed the data synthesis, single station analysis and index flood method. The findings were presented at the provincially sponsored conference on flood plain management and at a workshop at McGill University. Volume 2 of the report presents the results of the multiple regression method and Volume 3 contains the input data, plots of frequency curves and tabular information.

## Manitoba

The General, Mapping, and Studies Agreements were amended by an exchange of ministerial correspondence concluded on September 6, 1985 to extend the Agreements in time (4 years) and new funding of \$160 000 for additional mapping.

Designation packages were prepared for the communities of Arborg, Riverton, and Fisher Branch and are expected to be signed in the 1987-88 fiscal year.

Under the Canada-Manitoba Flood Protection Projects Agreement, the communication/storage facility in Morris was completed and emergency pumps for the communities on the west side of the Red River were constructed. The existing dyke at St. Adolphe has been upgraded but a new section to complete the north segment of the project has been delayed. A draft of an agreement between Manitoba and the U.S. Corps of Engineers to construct the international segment of a dyke to protect Emerson, Manitoba and Noyes, Minnesota is under review. The construction is planned for 1987-88.

In November 1985, Manitoba requested an amendment to the Canada-Manitoba Flood Forecasting Agreement to extend the time frame by 3.5 years with additional funding of \$400 000. The aim of the proposed amendment is to streamline the forecasting by shifting emphasis from model simulation to more practical activities such as the retrieval of real time data. Provincial Treasury Board authorization was received in February 1986, and federal approval, in January 1987.

## Saskatchewan

The General Agreement was amended and new Mapping, Studies, and Community Floodplain Management Measures Agreements were signed in March 1987. Contracts for public information maps were initiated for Melfort, Lumsden, Radville, La Ronge, Regina and Tantallon. A new public information strategy was prepared.

The hydraulic study for Tisdale was initiated with the report to be completed by May 1987.

## Alberta

The Province of Alberta has prepared a proposed draft agreement which combines elements of both the General and Flood Risk Mapping Agreements. The proposed agreement also forms the basis for sharing the costs of proposed structural measures. Negotiations are to commence soon.

## British Columbia

British Columbia has expressed interest in a Flood Plain Mapping Agreement at a shared cost of \$5 million over five years and a draft Agreement has been negotiated. A provincial Order-in-Council has been granted allowing the province to proceed with negotiations. The draft Agreement is undergoing federal review in preparation for obtaining the federal Treasury Board approval and Order-in-Council.

### Northwest Territories

Treasury Board approval was given to amend the General Agreement and Memorandum of Understanding. The amendment provides for a five-year extension to the program and the addition of the communities of Fort Liard and Nahanni Butte to the schedule of areas to be mapped. The amendment will be final upon completion of exchange of ministerial amending correspondence.

The Steering Committee approved the flood risk maps for Fort Liard, Nahanni Butte and Fort Norman. The Technical Committee accepted the results of the Tuktoyaktuk Driftwood Study. Work began on an examination of the complex ice jam flooding problem at Hay River. A flood forecasting agreement was drafted with a view to establishing a flood forecasting system for the Liard and Mackenzie river communities.

### Yukon

A proposed draft FDR agreement was under review by Environment Canada and Indian and Northern Affairs Canada. Two meetings were held with Yukon representatives to discuss the draft Agreement.

### Indian Lands

A short enabling Memorandum of Understanding between the Departments of the Environment and Indian and Northern Affairs (DINA) was signed in May 1985 to allow interested Indian bands, with the support of regional offices of DINA to take part in the flood risk mapping program. The work has a funding ceiling of \$300 000 per annum shared equally by the two federal departments. The program expires on March 31, 1990. Designation, which is intended to restrict development in flood risk areas, is not required. Four projects, two each in Ontario and Manitoba, were initiated in 1985-86. Topographic maps of the Sioux Valley and Lizard Point Indian reserves in Manitoba were completed. Hydraulic studies of both reserves are expected in 1987-88. In Ontario, a contract was being let for a historical review of flooding of northern Indian communities. Similar projects are under consideration in other provinces.

### Guidelines on FDR Program

A document, "Federal Guidelines for the National Flood Damage Reduction Program", was prepared in 1984-85 and subsequently distributed. The guidelines are intended as the main reference for federal managers of the FDR Program and are based on the originally stated aims of the program, the experience gained and precedents established over the years. To the extent possible, the guidelines attempt to anticipate the program's foreseeable future needs.

## Water Research Under the Canada Water Act

Research is carried out in the Inland Waters/Lands Directorate in support of operational Branches and departmental objectives. The in-house research programs are undertaken by the National Water Research Institute and the National Hydrology Research Institute. Support of related research in universities takes place through a subventions program. Undertakings are summarized below:

### 1. The National Water Research Institute (NWRI)

NWRI carries out water research under the Canada Water Act to advance understanding of water issues important to Canada. The knowledge and authoritative expertise developed from the Institute's research program is employed by Environment Canada (DOE) to influence decisions affecting the wise management of our water resources.

To achieve its goals, NWRI conducts a national, multidisciplinary program of targetted basic research, applied research and experimental development across the full spectrum of aquatic sciences, and develops research partnerships with the Canadian and international water science communities on priority issues. Because of its science expertise, the Institute is used by DOE to advise senior management on priority issues, to provide leadership on rapidly developing or emerging science programs, to represent DOE in national and international water science organizations, to provide functional guidance to operational water programs and to serve as public spokesperson on water-related issues.

During 1986-87, NWRI restructured both its program and organization, developing new or modified strategies for research, issue intervention and communications, as the basis for conducting business over the next decade. The Institute is now organized into flexible research projects consisting of multidisciplinary teams of scientists. Each project focuses on the development of knowledge, expertise and leverage for DOE on a specific priority issue. The projects are grouped administratively into three large multidisciplinary Branches, the Lakes Research Branch, the Rivers Research Branch and the Research and Applications Branch, supported by centralized research support, science liaison and staff support divisions. A number of initiatives have also been taken to develop and strengthen Institute linkages with universities, the private sector, the media and environmental groups and to position the Institute for more effective intervention in the management of priority issues, both within DOE and externally on behalf of the department.

The Institute's current research projects are organized around eight high priority water issues. Highlights of the 1986-87 research program are summarized below. In total, NWRI scientists published over 300 research publications and interpretive reports on the scientific aspects of these issues in 1986-87.

(a) Toxic Chemicals in the Great Lakes Connecting Channels:

A major research program is being conducted on the sources, pathways, fate and ecosystem effects of organic and inorganic contaminants in the interconnecting channels of the Great Lakes-St. Lawrence River drainage basin. Current efforts are focused on the St. Clair and St. Lawrence rivers, the riverine lakes within these rivers and the downstream settling basins. Critical processes, such as degradation, volatilization, adsorption and bioaccumulation of contaminants, are studied in relation to water residence times and other important limnological factors. The results are used to assess pollution impacts and the feasibility of remedial options.

Field work on the St. Lawrence River this year has documented the presence of volatile organics and heavy metals and tracked mirex throughout the river to its Lake Ontario source. Mirex was shown to be transported to the estuary more effectively by migrating eels than by traditional sediment transport. On the Niagara River issue, reports on toxic chemical pollution in the Welland River and canal were completed. NWRI scientists led in the development of the monitoring and data interpretation protocol to be used by the four parties to the International Niagara River Agreement in monitoring progress towards the target reductions of toxic chemicals. Data interpretation was also completed for input to the final report of the Canada-U.S. Upper Great Lakes Connecting Channels Study, which will recommend a Rehabilitation Action Plan and surveillance program for the St. Clair, St. Mary's and Detroit rivers.

(b) Lake Restoration:

Research is conducted to develop expertise and practical technologies for restoring lakes from the effects of nutrient and toxic chemical pollution. Attention is currently focused on Hamilton Harbour, a seriously polluted IJC "Area of Concern", on aquatic weed infestations in Ontario and on eutrophication trends in the Great Lakes.

An experimental oxygen injection apparatus with the potential to improve the water quality of Hamilton Harbour was tested this year. By reoxygenating the bottom waters, heavy metals are precipitated, organic contaminants are degraded and fish habitat restored. Institute scientists also led in the preparation of an interim report on a multi-agency Remedial Action Plan for the Harbour. Dramatic die-backs of eurasian water milfoil in central Ontario were traced to the natural appearance of an exotic insect larva which is killing the weed. Factors controlling its distribution are being studied to determine the

feasibility of biological control. Surveillance trend data from the Great Lakes on phosphorus, nitrogen and algae (including *Cladophora* infestations) were evaluated as part of the Institute's responsibilities under the Great Lakes Water Quality Agreement.

A major new project was also initiated to examine the relationships between trophic status (productivity) and toxic chemical effects in lakes. There is some evidence that the vulnerability of lake biota to toxic chemicals may increase as lake productivity decreases. If so, continuing reductions in phosphorus loadings to the Great Lakes, for instance, may unintentionally maximize exposure of fish and other biota to contaminants already in the system. Processes of bioaccumulation, degradation and sedimentation are being studied in experimental lakes, lake enclosures and microcosms.

(c) Contaminated Sediments:

Previously contaminated bottom sediments are a major source of toxic chemicals to the overlying waters and biota of lakes. This project is examining the physical and biogeochemical processes controlling lake sediment-water interactions, including sediment deposition and resuspension, chemical release rates, microbial degradation and biotoxicity. Results are used to evaluate remediation options in specific areas of concern in the Great Lakes and elsewhere.

A synoptic resurvey of Lake Ontario sediments was completed this year using modern methods developed at NWRI. The results, compared to data from the 1960s, indicate that toxic chemicals in surface sediments have been strongly redistributed throughout the basin and have declined significantly in the last 20 years. The data also show that past methods strongly underestimated the concentrations of some pollutants. These results have important implications for estimating recovery rates, loadings to the St. Lawrence River and the contribution of airborne contaminants to the lake.

(d) Ground Water Contamination:

In this project, research is conducted on the physical and chemical processes which control the migration, fate and effects of toxic contaminants in the subsurface sedimentary rock aquifers of eastern and central Canada. Results are used to develop general and site-specific protocols for aquifer monitoring and decontamination and for waste site rehabilitation. The current focus is on transboundary problems in the St. Clair and Niagara rivers and on the use of aldicarb, a potato-farming pesticide, in Prince Edward Island.

Field results from the PEI studies have shown that aldicarb is present in well waters at levels near or above current drinking water guidelines. Evidence suggests that low temperatures and pH at the time of application in the early spring are inhibiting the normally rapid degradation of the pesticide. Tests to determine if delayed application can minimize well pollution are forthcoming. Extensive expert advice was also provided to U.S.

and Canadian agencies regarding the hydrogeology of the St. Clair and Niagara rivers.

(e) Pesticide Assessment:

Pesticide research at NWRI leads to the development of new analytical methods and to better understanding of the occurrence, persistence, pathways, fate and ecotoxicological effects of pesticides in lakes and rivers. The information and expertise is used to advise Agriculture Canada and other federal agencies concerned with pesticide registration, impact assessment, water quality objectives and environmental surveillance.

Pesticide studies were carried out this year in several locations across Canada. Tributyltin, an extremely toxic compound used as an antifouling agent in marine paints and as a lumber preservative, was found in harbours, marinas and shipping channels across the country, sometimes at concentrations high enough to affect sensitive organisms. It was also shown to have a summer half-life in freshwater of up to three months. Based on these results, paint formulations containing tributyltin may need to be registered under the Pest Control Products Act. In B.C., studies in the Fraser River estuary have documented the presence of various forms of chlorophenols, a heavily used wood preservative, in the waters, fish and other organisms in the estuary. They have also proven that the source of the chemical is the lumber industry; chlorophenol isomer ratios in the water matched those from the product used extensively by industry. These results will be used in the development of a Canada-B.C. water quality management plan for the estuary. Pesticide research is also underway in the Yamaska River basin, Quebec, and at several locations in Atlantic Canada and Ontario.

(f) Acid Rain:

NWRI research on acid rain focuses on the development of knowledge required for federal policy formulation. Current priorities include: the evaluation of critical watershed acidification and recovery processes (based on field research at the Turkey Lakes experimental facility); the spatial and temporal definition of aquatic resources-at-risk; the evaluation of U.S. predictive modelling efforts together with the development of alternative Canadian models for policy development; and the scientific assessment of the national acid rain monitoring program.

A major NWRI report this year confirmed that large numbers of lakes in eastern Canada are fully acidified and provided convincing evidence relating these effects to atmospheric sulphate deposition. These important conclusions were reflected in the latest report of the Bilateral Canada/U.S. Advisory and Consultative Group. New findings from the Turkey Lakes also showed that a temporary decrease in acid rain, resulting from the economic recession in the early 1980s, permitted moderately acidified lakes to recover quickly. Ecosystem acid-rain models developed at NWRI successfully simulated these recovery processes.



(g) Air/Water Interactions:

Evidence is mounting that pollutants in the atmosphere are evoking major changes in climate and that the atmosphere is a major source of toxic chemicals to Canada's lakes, the Great Lakes in particular. The air-water research program at NWRI focuses on the processes which control the rates of deposition from, and volatilization to, the atmosphere of persistent organic chemicals. The effects of long-term climate change on the physics and the water quality of the Great Lakes will also be examined.

To assist in defining the research dimensions of the "toxic rain" issue, the Institute hosted a science-policy forum for DOE scientists and policy analysts. NWRI scientists were also instrumental in the organization of an IJC Workshop on the "Role of the Atmosphere as a Source of Toxic Chemicals to the Great Lakes".

Measurements of radionuclide fallout from the Chernobyl nuclear accident were obtained from rainwater and lake samples across Canada. While concentrations were too low to pose an environmental health concern, these measurements provided dramatic evidence of the global nature of toxic rain.

(h) Aquatic Monitoring and Assessment:

Improvements in departmental surveillance, monitoring and assessment programs are critically dependent on new methods, instruments, protocols and a range of mathematical models. Several NWRI projects serve this broad operational need and, at the same time, contribute to the Institute's research on other issues. The Analytical Chemistry project develops or modifies methods to measure organic and inorganic compounds in water, sediments and biota and provides a national focus for quality control/quality assurance activities. The Ecotoxicology project provides new biological assessment procedures for detecting the toxic and mutagenic effects of contaminants in lakes and rivers. Monitoring/modelling projects, in both the water quality and quantity areas, provide expertise on the design, rationalization and interpretation of monitoring and surveillance programs. A variety of statistical and process simulation models to permit reliable trend assessment, analysis and prediction of aquatic processes are also developed.

A large-volume extractor system, which permits field collection of a concentrated extract of toxic chemicals which occur at very low levels in water, has proven efficient and reliable. A portable version has been deployed for use in the Niagara River Monitoring Program and the Great Lakes Surveillance Program. Several novel chemical and ecotoxicological methods were developed and transferred to operational use. Interlaboratory quality assurance studies were completed for Water Quality Branch, federal/provincial, LRTAP, GLWQA and UGLCC programs; general data quality is improving and problems with data comparability and accuracy from the centralized national laboratory are being resolved. A predictive ice-jam model, and improved versions of the RIVMIX and MOBED models for rivers

were completed. Specific water quality models in support of LRTAP, Fraser River, Kaministiquia River, North Saskatchewan River, Mackenzie River, sediment water quality and pesticide transport studies were developed or improved.

## 2. The National Hydrology Research Institute (NHRI)

NHRI specializes in research related to the flow and quality of both surface and ground water, and to snow and ice. The construction of a permanent home for the Institute at Saskatoon was completed in April 1986 and occupation of this new facility occurred three months later.

The consolidation of a broad range of water research activities in a single research facility at Saskatoon in 1986 makes possible for the first time a planned approach to integrated multi-disciplinary investigations focusing on western and northern water resource problems. This research thrust at the Institute was reinforced in 1986-87 by the addition of a hydrometeorological research group from the Atmospheric Environment Service (AES). Also based at the National Hydrology Research Centre are the regional water quality laboratory of IWD's Water Quality Branch and the AES Saskatoon Inspection Services.

### (a) Ground Water Research:

The major activity in the past year has been the restructuring of NHRI's ground water program subsequent to the move of the Institute to Saskatoon. The aim of this restructuring has been to more adequately address ground water related concerns in Western Canada, while maintaining an overall national perspective on and responsibility for ground water research.

Although some details remain to be worked out, the NHRI ground water research program will be focussing on the following major issues, all of which are high priority departmental concerns: 1) pesticides in ground water; 2) ground water for economic development; 3) climatic change and ground water; 4) ground water in the North; and 5) sub-surface disposal of industrial wastes.

Work on ground water and Long Range Transport of Air Pollutants (LRTAP) will be gradually wound down as existing studies are completed and resources freed up re-allocated to the newly identified priority concerns. All work on LRTAP is scheduled to be terminated by March 1989.

Work sponsored by Atomic Energy of Canada Limited on the ground water aspects of high level nuclear waste disposal has been completed; the work has all been written up for publication and most has already been published.

As the clean-up of contaminated ground water from chemical dumps is at present primarily a concern in the more industrialized areas of eastern Canada and as the technical solutions tend to be very site specific, work on this issue has been transferred to a small unit at the National Water Research Institute, newly created for just this purpose.

The scientific implications of these changes for the NHRI ground water program are:

- In the pesticides-in-ground-water project, initial attention is being focussed on establishing the dimensions of the problem (e.g. is pesticide contamination of ground water just a number of more or less isolated occurrences or is there a more pervasive overall problem?) As much of the data and information available are based on questionable sampling and analysis practices, priority is being given to establishing reliable and scientifically sound sampling and analysis protocols.
- A number of ground water studies are addressing the economic-development issue. These include studies on artificial recharge, the influence of land management practices on the availability and quality of ground water, and improvements to existing ground water extraction technologies.
- The influence of climatic change on all segments of the hydrologic cycle - including ground water - is potentially enormous, but at present essentially unpredictable. Impacts are likely to be greatest in the North (e.g. thawing of permafrost), but influences could extend south to, and well beyond, the boundary with the United States. Initial work on this issue will involve the establishment of a reliable database on which to base predictive models to be developed later.
- In addition to the concern for climatic change, issues in the North include the impacts of toxic precipitation and other influences on the quality of sub-surface water. As with climatic change, immediate plans focus on establishing a reliable body of data on which further research will be based.
- Sub-surface injection of waste fluids in Western Canada is an activity of particular significance, but one where not enough is known about the interactions between the fluids and the formations into which they are injected. NHRI's involvement in this area will be through research (largely contracted) to investigate these reactions.

(b) Surface Water Research:

Surface water research emphasizes the investigation of watershed processes, particularly those that characterize elements of the hydrologic cycle rather than the ground water. Hydrologic processes in permafrost, alpine and prairie environments are of particular interest. This array of studies includes the interactions between Arctic streams and permafrost, lake dynamics and flooding in the Mackenzie Delta, fluvial processes in the Mackenzie Delta, and the processes controlling the impact of land drainage on the streamflow characteristics of watersheds. Modelling activities are concentrated on the development and testing of precipitation-runoff models including the design of statistical streamflow characteristics of watersheds, the design of statistical streamflow forecasting models with and without climatic forecasting ability, a model of snowmelt in the Mannes-Domain drains of southern Manitoba and its partitioning into soil moisture, ground water, surface ponding,

evaporation and runoff, and the sensitivity analysis of a passive microwave snow cover model to a range of snow cover and soil moisture conditions.

Prairie Hydrology: Research in the prairie hydrology section is focussed on snow management, snowmelt infiltration and snowmelt runoff in a prairie environment; runoff from the Sentinel Glacier, application of passive microwave imagery to monitor spring flooding and subsequent drying of fields; evaluation of the Complementary Relationship Areal Evapotranspiration (CRAE) model; and the quantity and quality of irrigation return flow.

A cooperative study with Agriculture Canada and the University of Saskatchewan has been initiated to determine the effects of snowmelt enhancement by tillage practices; meltwater enhancement in cracked soils and the effect of snow management and tillage practices on surface runoff and ground water recharge. Such studies will be of direct benefit to primary producers who are looking for methods of extending the cropping system to overcome problems of land degradation and soil salinization.

Based on results from the Agricultural Land Drainage Project, the effect of open drains trapping winter snow and blocking snowmelt drainage was shown to be a major factor in governing spring runoff. These studies suggest that municipal drains should be opened prior to spring runoff in order to be effective. A Penn State Runoff Model calibrated for the Domain Basin in the land drainage study indicated a relatively small source area (3% of the basin) produced 80% of the runoff. On the same project, passive microwave imagery from the Nimbus satellite was used to prepare maps that indicated the flooding and subsequent drying of fields in the Red River clay region.

The results of cooperative study with Alberta Environment and Agriculture Canada to evaluate the CRAE model to estimate evapotranspiration have been encouraging. Estimates for a dryland cropped and grassland sites in Southern Alberta were reasonable whereas the model underestimated evapotranspiration for an irrigated site. With further refinements in the required instrumentation, it is anticipated that a reliable method of estimating evapotranspiration to assess the effects of land use will be soon available to water resource managers.

Preliminary results from a cooperative study with Agriculture Canada and the Saskatchewan Research Council on the quantity and quality of irrigation return flow from surface irrigation indicate approximately 14% of the applied irrigation water is returned as surface drainage water. With respect to quality, there is evidence of some loss of applied nutrients and herbicides to drainage water. Further study and analysis are required to confirm the 1986 results.

Mountain Hydrology: Permanent and seasonal snow and ice are important elements in the mountain hydrology research program. Glaciers can provide climate data, information on

long-range transport of atmospheric pollutants and contribute significantly to water supply. The cores from Mount Logan have now been analysed for their oxygen isotopes ratio which indicates the temperature at which the snow fell. Precipitation amounts recorded in the annual snow and ice layers correlate with one of similar length from Siberia.

Accumulated records on Canadian glaciers have been relocated from Ottawa to Saskatoon and are now being reorganized and catalogued. Information on glacier variations, glacier mass balance and special glacier events, from 1980-1985, has been compiled. Assessment of annual mass changes on Sentinel, Place, Helm and Peyto glaciers was continued and showed that all glaciers surveyed were losing mass during the balance year.

Snow structure and its metamorphism influence melt rates and run-off characteristics. Studies continued on the analysis of snow specimens to find parameters that best describe snow microstructure. Particular emphasis is now being placed on the dielectric properties.

Northern Hydrology: Research activities have continued in the Mackenzie basin related to the effects of possible future regulation of Liard-Mackenzie flow, and to potential oil and gas developments in the Mackenzie-Beaufort region. A major focus has been placed on understanding of hydrologic regime of lakes and channels in the Mackenzie Delta. Recent progress has been made on understanding the flow pattern into, out of and through low sill elevation lakes; on determining the sill elevations of a large number of lakes; and on developing a model to predict lake levels. Water balance work has indicated that the high sill elevation lakes are dependent on flooding, primarily from spring ice jams. A new study is being initiated to determine the spatial extent of backwater flooding produced by such jams.

River ice research continues on the Liard and Mackenzie rivers, focussed primarily on the study of ice jams which form at the confluence of these two rivers. The physical characteristics of thermal and mechanical break-ups have been identified and an ice jam stage-discharge relationship defined.

Work is finishing on determining the processes controlling water temperature in ice-covered rivers and developing a model predicting both cross-channel and temporal changes in temperature. The convective heat flux from the water to the overlying ice cover and the importance of hydrothermal heat flow to ice jam decay have been established.

In support of the river ice work, a review has been conducted of various methods to measure discharge during the period of ice break-up and tests of a resistivity probe for measuring ice thickness have been completed. Reports on all of the above aspects of the river ice program have been published.

A new project will concentrate on the interaction of snowmelt water with frozen soils in a permafrost environment. This includes soil heat flux, soil infiltration, and the formation of basal ice, and the effect of each on snowmelt runoff. Initial results have demonstrated

that these processes significantly delay the initiation of runoff and therefore have important implications for the hydrology of lakes in the Mackenzie Delta.

### 3. Water Resources Research Subvention Program

In 1986-87, 9 universities across Canada received a total of \$160 000 in grants to carry out research as an adjunct to the Inland Waters/Lands Directorate in-house research programs. The 13 water-related environmental research projects supported were focussed on regional and national water research topics associated with acid rain, toxic substances, land drainage, sediment transport, flood damage reduction and innovative water resources research. The aims of the program are to stimulate development of water resources research across Canada, to encourage development of innovative ideas by non-governmental scientists, and to foster closer contact between those scientists and their counterparts in Environment Canada.

### Other Water Management Activities

Not to be overlooked in the review of operations under the Canada Water Act are various activities which provide indispensable information for effective water planning and management.

Socio-Economic Studies: A continuing but growing recognition of the socio-economic dimensions of water resource policy, planning and management manifested itself in various ways during 1986-87. At Headquarters, among the more important efforts were a) the initiation of the fourth national survey of industrial water use, covering some 7 500 establishments, b) the formulation and establishment of a National Water Use Analysis Program, c) the commencement of a national water use database, d) the development of a draft Federal Fresh Water Policy, in response to the recommendations of the Inquiry on Federal Water Policy, and e) work toward greater public water awareness. In the regions, highlights included a) the construction of a water use optimization model for the Okanagan basin, b) the start of a comprehensive federal-provincial water management study in the Saskatchewan portion of the South Saskatchewan River basin, c) the production of reports on toxic chemicals, pollution abatement and high water levels in the Great Lakes ecosystem, and d) completion of a water use modelling study in the Saint John River basin.

Development of a study analyzing the nature of water supply constraints to energy development, largely in Western Canada, continued. Improvements to the water use analysis model included enhancements and expansion of the model's database, the addition of interactive graphics routines to facilitate analysis and presentation of results, addition of two more major reservoirs to the database, and the running of more water use scenarios of future socio-economic and water resource developments in Western Canada. A number of reports based on the model were either completed or are under way.

Municipal infrastructure improvement and financing became an important issue during 1986-87, especially given the fiscal restraints of the federal as well as the other levels of government. To define the problem more clearly and to develop options for dealing with it, a major CCREM study of water cost and pricing was begun. To support this study, the data on municipal water use and pricing gathered in previous national surveys were organized in a municipal water use and water pricing database. This is seen as part of the movement toward a rationalized pricing system that will encourage people to conserve water, raise the funds needed to build and maintain costly water systems, and encourage technical innovation that will slash capital and operation costs.

Internationally, contributions were made to workshops and seminars held by the Economic Commission for Europe, The Organization for Economic Cooperation and Development and the International Water Resources Association. Presentations on Canadian water management were made at these meetings covering policy integration and ground water management. Support was provided in organizing the 1988 World Water Congress of the International Water Resources Association in Ottawa.

Socio-economic policy advice was provided on a wide range of issues including socio-economic capability within Inland Waters/Lands Directorate, flood damage reduction, climatic change impacts on water use and water rentals to power companies.

Water Data: Programs for the systematic collection and compilation of data on streamflow, water levels, sediment transport, ground water, water quality, and related information on glaciers, snow and ice predated the Canada Water Act but have continued to operate in support of water management basin studies and implementation programs. A newer innovation is the collection of background data on water use by municipal and industrial users in Canada.

At the National Water Research Institute in Burlington, Ontario, water data activities in support of water data collection include programs of quality assurance and analytical methods adaptation for the water quality program and current meter calibration for the water quantity program.

Data Management Systems: Data and information reference systems continue to be operated in support of water resource activities. WATDOC, the water resource document reference centre, gives direct access nationwide by computer terminal to an inventory listing of published water-related papers and reports through a publicly available on-line interactive storage and retrieval system. This reference system was recently broadened to cover environmental baseline data in general. NAQUADAT, the national water quality monitoring program's data bank, was designed to store and retrieve chemical, physical, bacteriological, biological and hydrometric data relevant to water quality for surface waters, ground waters, wastewaters and sediments. STAR, a data storage and retrieval system, was developed to handle limnological data from Great Lakes monitoring cruises.

WATENIS, the water effluent national information system, provides an inventory of industrial and municipal water pollution sources including data on physical, chemical, and toxicological characteristics of effluents and information on water effluent regulations and guidelines. MUNDAT, a database covering municipal waterworks and wastewater systems from coast to coast, including data on federal facilities, was developed in close cooperation with the provincial governments and the Federation of Associations on the Canadian Environment (FACE). HYDAT, the national surface water data bank has been developed to store and retrieve streamflow, water levels, and sediment transport information collected under the Federal-Provincial Water Quantity Agreements; it also includes water quantity data contributed by other organizations that meet national standards in data collection procedures and accuracy. A Glacier Data and Information System has been designed to contain a compilation of physical dimensions of Canadian glaciers and a bibliography of Canadian glacier documents. CHOMS is a database which provides an inventory and summary description of selected operational techniques and procedures used to collect, process and manipulate hydrologic data in water resources studies. The CHOMS database was developed as the Canadian contribution to the HOMS project of the World Meteorological Organization (WMO) for the organized transfer of hydrological technology operationally used in water resources investigations by member countries of WMO.

## PART II: Water Quality Management

No water quality management areas, as defined under Part II of the Canada Water Act, have been set up. However, there are a number of federal-provincial implementation agreements under which water quality management programs have been or are being implemented. These include programs in the Great Lakes basin and in the Okanagan and Qu'Appelle basins. While these agreements do not provide for the establishment of water quality management agencies under Part II of the Act, they nevertheless have the same objectives of maintaining and improving water quality and are managed by joint federal-provincial Boards. The federal government, in concert with provincial governments, has completed the development of water quality management strategies for the St. Lawrence River (Quebec), the Souris River (Manitoba-Saskatchewan), and the Shubenacadie-Stewiacke Rivers (Nova Scotia). Also, a Canada-Ontario-Quebec Coordinating Committee is working to establish a water quality monitoring plan for the Ottawa River, a Canada-British Columbia Committee is overseeing the implementation of a Management Program in the Fraser River Estuary, and a Canada-Manitoba Team is undertaking to monitor and study mercury in the Churchill River diversion.

In 1983, the Canadian Council of Resource and Environment Ministers (CCREM) established a Task Force on Water Quality Guidelines to address the problem of the many different water quality guidelines and objectives in use across Canada and to consider the possibility of harmonizing these guidelines. In October 1984 the Task Force recommended, and the CCREM agreed, that



harmonized Canadian guidelines should be developed. In response, the Task Force prepared the "Canadian Water Quality Guidelines". CCREM approved the guidelines in October 1986 and has scheduled their publication and release for May 1987. The guidelines consist of information on specific water quality parameters which indicate whether the quality of water in a water body is suitable for such major uses as recreation and aesthetics, aquatic life, irrigation, livestock watering and industrial water supplies. Site-specific water quality objectives can then be developed using the information contained in the guidelines. In 1987, the Task Force will also produce a report on research needs identified during the preparation of the Guidelines. This report will help orient future research so that it will be useful in the preparation of new and revised guidelines for water quality.

### PART III: Regulating Nutrient Inputs

The federal government launched its phosphorus concentration control program in the late 1960s. Regulations limiting the maximum phosphorus content of laundry detergents to 8.7% elemental phosphorus ( $P_2$ ) by weight, or 20% phosphorus pentoxide ( $P_2O_5$ ), were established in 1970. At that time, an inspection program was introduced under which product samples were collected from manufacturers and importers for government analysis. On January 1, 1973, the maximum permissible phosphorus content for laundry detergents was further reduced to a maximum of 2.2% elemental phosphorus by weight (or 5%  $P_2O_5$ ). It is estimated that these regulations have reduced the preregulation levels of phosphate discharged from all detergent sources from 26 000 000 kilograms to 5 000 000 kilograms per annum.

In 1973, a national network of regionally based inspectors was formed. Since that time samples of laundry detergents and other products have been collected and analyzed on an annual basis. In the 1986-87 fiscal year, 124 random samples of commercially available laundry detergents were collected and analysed for phosphorus content. Of these, only one was found to contain phosphorus in excess of the regulated limit.

The initial concern about phosphorus in laundry detergents centred on the identification, in the Great Lakes, of eutrophication (accelerated aquatic plant growth due to an overabundance of nutrients such as phosphorus). However, the detergent regulations under the Canada Water Act are not only meant to apply to phosphorus control in the Great Lakes; they also are designed to protect the myriad of small Canadian lakes which were suffering from eutrophication and were not, and likely will not, be serviced by centralized facilities that could be upgraded to tertiary treatment for the removal of phosphorus. The Phosphorus Concentration Control Regulations (1973) are necessary to protect small lakes throughout Canada.

#### PART IV: Public Information Program

A broad range of water management activities were announced during fiscal year 1986-87.

An announcement on April 29, 1986 dealt with the signing of a Canada-Newfoundland Water Quality Monitoring Agreement, a further step towards the establishment of a Canada-wide water quality network.

An announcement on May 28, 1986 preceded the signing of a \$1.6 million agreement for a joint Canada-Saskatchewan planning study of the South Saskatchewan River basin in Saskatchewan.

On October 30, 1986, the Niagara River Toxics Management Plan was announced, outlining the intent of the coordinated effort by Canada, the United States, Ontario and the State of New York to eliminate virtually all toxic chemicals in the Niagara River from all sources. The four parties formalized the Management Plan by signing a "Declaration of Intent" in February 1987 to work together to fully implement the Management Plan and to issue a public report every six months on the progress being made.

Early in January 1987, the Great Lakes Water Level Communications Centre mailed letters to 270 Great Lakes communities offering technical information to municipal officials and open-house meetings for the general public.

Announcements in February and March 1987 preceded the designation of Rushoon, Newfoundland, as well as five other designations in Ontario, all under federal-provincial Flood Damage Reduction Agreements.

In March 1987, an agreement was announced respecting an amended General Agreement as well as new Agreements between Environment Canada and Saskatchewan for Flood Hazard Mapping, Studies and Community Flood Plain Management Measures.

Also in March 1987, the Environment Canada Minister and his counterparts in Quebec and Ontario announced improvements in Ottawa River water quality through the release of the first annual report of the Ottawa River Co-ordinating Committee for Water Quality.

## PRINCIPAL FEDERAL-PROVINCIAL COOPERATIVE ARRANGEMENTS UNDER THE CANADA WATER ACT

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## REGULATION, APPORTIONMENT, MONITORING AND SURVEY PROGRAMS

### 1. WATER QUANTITY SURVEY AGREEMENTS

Objective: To maintain a viable and efficient national water quantity survey network and to give recognition to joint federal and provincial responsibilities in this activity.

Duration of Agreements: Agreements between Canada and each province were signed in 1975 and letters were exchanged between the Department of Environment (DOE) and the Department of Indian and Northern Affairs (DINA) agreeing to joint survey operations in the provinces and territories. The programs are continuous but there is a provision in each agreement for termination on 18 months written notice.

Participants: CANADA.....Department of the Environment, and  
the Department of Indian and Northern Affairs  
representing the Yukon and Northwest Territories.  
ALL PROVINCES

Arrangements: Data are gathered, analyzed and interpreted to meet client's needs in the hydrologic community. This is a shared-cost program, with the federal government carrying out field and office procedures and invoicing the provinces quarterly. An exception is Quebec which operates the program in that province and invoices the federal government quarterly except for international and navigable waters, and waters crossing federal land in Quebec, which are surveyed by the federal government. DINA transfers funds annually to DOE for the territories' share of costs.

Funding: 1986-87 (provisional costs)

Total Program Costs	\$24 574 300
Total Recovered from Provinces	5 359 800
Total Paid to Quebec by Canada	689 000

Total Program Costs are the expenditures required to conduct the National Water Management Data Program.

The Total Recovered from Provinces is the amount reimbursed by the provinces, except Quebec, to Canada. The Total Paid to Quebec by Canada is the amount paid by Canada to the Province of Quebec for operating stations of federal interest in that province.

Status: Coordinating Committees, established for each province, convene at least annually but normally more frequently to review the water quantity survey networks and to determine annual cost sharing. National meetings of all Coordinating Committees are convened periodically to ensure common practices are followed in administering the Agreements.

Water quantity surveys now include technologically advanced techniques such as satellite communication telemetry systems and a nationally distributed electronic data processing system.

## 2. WATER QUALITY MONITORING AGREEMENTS

Objective: To establish a nationwide water quality monitoring network that will make it possible to assess water quality on a national basis and at the same time meet the needs of the provinces.

Duration of Agreement:

To March 31, 1987, Agreements have been signed with Quebec, British Columbia and Newfoundland. The Agreements contain no termination date, but there is provision for termination by either party within a specified period of time after written notice. Agreements with other provinces will contain similar provisions.

Participants:

CANADA....Dept. of the Environment  
ALL PROVINCES

Arrangements:

In designing the Agreements to meet the needs of both the federal and provincial governments, the party(s) who will conduct the work are identified, and the costs of the program are shared in accordance with the value of the information to each party.

Funding:

Costs are determined according to the schedules appended to each Agreement. Federal stations will be funded 100% by Canada; provincial stations will be funded 100% by the province; federal-provincial stations will be funded equally by each party. Treasury Board provided \$2 139 000 for the Agreements in 1985-86.

Status:

The Agreements with Quebec, British Columbia and Newfoundland became effective in 1983, 1985 and 1986, respectively. Negotiations for Agreements with Manitoba, Ontario, Saskatchewan, New Brunswick and Prince Edward Island are progressing. Negotiations have begun with Yukon and the Northwest Territories, and are scheduled to begin with Nova Scotia in 1987.

## 3. PRAIRIE PROVINCES WATER BOARD

Objective: The equitable apportionment of interprovincial prairie waters flowing eastward. The agreement ensures that one half the natural eastward flow of waters arising in or flowing through Alberta is reserved for Saskatchewan, and that one half the eastward flow arising in or flowing through Saskatchewan is reserved for Manitoba.

Duration of Agreement:

Continuous since October 30, 1969.

Participants and Funding:

CANADA  
ALBERTA  
MANITOBA  
SASKATCHEWAN

(Funding to be borne one-half by Canada and one-sixth by each of the provinces.)

Arrangement:

Schedule C of the Agreement provides for the reconstitution of the Prairie Provinces Water Board whose responsibility is to oversee and report on apportionment of waters flowing from one province into another province; to take under consideration comprehensive planning, water quality management and other management problems referred to it by the entities

concerned; to recommend appropriate action to investigate such matters; and to submit recommendations for resolution of the problems.

Status:

The Agreement is administered through the Prairie Provinces Water Board, its five Committees, and its Secretariat.

The Board's Committee on Hydrology has recommended procedures for the determination of natural flow and streamflow forecasting for five major interprovincial basins in the area. Natural flows are calculated on an annual basis for eight drainage basins. Natural flow reports showing recommended procedures to determine natural flow have been prepared for fourteen other smaller drainage basins crossing provincial boundaries. The Board has approved the Committee's report that describes the mechanisms required to administer the 1969 Apportionment Agreement, and reports on the apportionment implications of westward flowing streams, and westward flowing tributaries of eastward flowing streams. It is now developing a workable strategy to deal with interprovincial drainage problems. Article 6 of Schedule A of the Master Agreement on Apportionment has been amended to allow for apportionment of the flow of Battle, Lodge and Middle Creeks at the Alberta-Saskatchewan boundary, and the Committee on Hydrology now monitors apportionment of those three creeks.

At the request of the Board, the Water Quality Branch of Environment Canada reports monthly on water quality at eleven monitoring sites. These stations are part of the basic long-term network proposed by the Board to monitor water quality in the prairie provinces. The Board's Committee on Water Quality has prepared water quality indicators for each of these eleven stations. The indicators were presented to the Board in the fall of 1986 and are now being reviewed by the Board's agencies prior to any further action being taken. This Committee, under the direction of the Board, also has established a task force on analytical methodology to provide a means of coordinating water quality laboratory results for the prairie provinces and has submitted to the Board a draft report suggesting administrative procedures that might be used in defining, monitoring and administering interprovincial water quality requirements.

The report entitled "Water Demand Study - Historical and Current Water Uses in the Saskatchewan-Nelson Basin" was released to the public on February 10, 1983. The water use information in that report is updated annually and both the study results and the updated information are being stored in a computerized format for retrieval by interested agencies and individuals.

The Board's Committee on Interjurisdictional Agreements Administration has proposed an interim method of administering the interprovincial waters of Boxelder Creek basin. The Board accepted the Committee's recommendations in January 1984 and the Board's Secretariat implemented those recommendations in 1984 and 1985.

The Board's Committee on Groundwater has prepared reports showing cross-sections, or profiles, of ground water conditions along the Alberta-Saskatchewan boundary (1985) and the Saskatchewan-Manitoba boundary. The Committee is also coordinating the tabulation of a bibliography of ground water reports and data related to interprovincial ground water evaluations.

The Board also evaluates the effects that proposed projects might have on streamflow in downstream provinces. The results of each such evaluation are reported to the respective Ministers of the Board.

#### 4. OTTAWA RIVER REGULATION PLANNING BOARD

Objective: To plan and recommend criteria for regulating the Ottawa River, taking into account hydro-power production, flood protection, navigation, low water problems, water quality needs and recreation.

Duration of Agreement: Continuous since March 1983

Participants: CANADA (3 members)  
ONTARIO (2 members)  
QUEBEC (2 members)

Canada assumes initial responsibility for financing the cost of the Agreement with Ontario and Quebec each contributing 25%.

Prior Action: As a result of recommendations made following a study of flooding in the Montreal region in 1976, a Canada-Ontario-Quebec Ottawa River Regulation Planning Committee was established in 1977 by an exchange of letters between the federal minister of the Environment, the Quebec minister of the Environment and the Ontario minister of Natural Resources. The final report of the Planning Committee was submitted in December 1980 recommending that a tripartite regulation agreement be negotiated. Negotiations then followed, culminating in the signing on March 2, 1983 of a Canada-Ontario-Quebec Agreement Respecting Ottawa River Basin Regulation.

Arrangement: The Ottawa River Regulation Planning Board administers the agreement. It also formulates and reviews regulation policies and criteria concerning integrated management of the principal reservoirs in the basin.

A regulating committee, composed of operators of the principal reservoirs, is responsible for ongoing operation of the reservoirs, within the guidelines established by the Board.

Status: A secretariat has been established within Environment Canada to act as the executive arm of the Board.

During the spring flood period (March 1 - May 30), forecasts on a real-time basis are provided daily for the principal reservoirs in the Ottawa River basin and at selected points where flooding takes place.

The mathematical regulation model is operated on a real-time basis during the spring flood period to serve as a guide to reservoir operations. In 1986, flood reserves were implemented in three reservoirs, on a trial basis to facilitate the operation of the Mille Iles dam.

Subcommittees have been established to study the impact of using flood reserves in some reservoirs, to develop risk management methodology for the Ottawa River basin and to develop bylaws and procedures for the Board.

5. OTTAWA RIVER WATER QUALITY COORDINATING COMMITTEE

Objective: To review and modify the proposed monitoring plan and oversee its implementation; to undertake or recommend special studies as needed; and to recommend water quality objectives for the river.

Duration of Agreement: Continuous from 1983

Participants: CANADA  
QUEBEC  
ONTARIO

Prior Action: A Technical Work Group on Water Quality in the Ottawa River was formed in 1980 to study problems related to bacteria and toxic substances in the Ottawa River basin; to identify quantities and sources of nutrients, and to evaluate the importance of agricultural and other diffuse sources of phosphorus. It was hindered from carrying out its mandate by gaps in the data available and, in its report of October 1981, recommended the establishment of a committee to coordinate monitoring, and proposed a monitoring plan to obtain the data needed.

Status: The first annual report of the Coordinating Committee noted some improvement in water quality in the river, particularly in bacterial quality, and recommended adoption of water quality objectives and emphasis on control of nutrients, bacteria, dissolved oxygen and PCBs. In the coming year, the Committee plans to obtain more information on dissolved oxygen, trace organics and trace metals, and to develop additional water quality objectives.

6. MACKENZIE RIVER BASIN COMMITTEE

Objective: To exchange information on potential water-related developments in the basin and to formulate a program of studies to gather data on the basin's water and related resources.

Duration of Agreement: Continuous since 1973.

Participants: CANADA.....Department of the Environment,  
Ministry of Transport, Department of Indian  
and Northern Affairs, Yukon Territory, and  
Northwest Territories.  
ALBERTA  
BRITISH COLUMBIA  
SASKATCHEWAN

Prior Action: The Mackenzie Basin Intergovernmental Liaison Committee was established in 1973 and reconstituted as the Mackenzie River Basin Committee in a Memorandum of Understanding between the participating governments in May 1977. In May 1978, a \$1 600 000 program to study the water and related resources of the basin was endorsed.

The study has been completed and the final report was released by the Ministers on February 26, 1982. The main recommendations call for early negotiations toward a transboundary water management agreement, an expanded network of water data stations, follow-up field studies on ice breakup and a major study of the Mackenzie Delta.



Status:

The Mackenzie River Basin Committee continued to meet during 1986-87 to fulfill its liaison responsibilities and to consider study designs, budgets and agreements associated with future implementation of Recommendations 2 and 5 as well as a general agreement which would grant member status to the governments of the Northwest Territories and Yukon. Implementation of Recommendation 1, an agreement through which transboundary water management issues can be addressed, is being pursued outside of the Mackenzie River Basin Committee. Seven bilateral subagreements between the various jurisdictions will precede the development of a master agreement under the Canada Water Act. Bilateral discussions between Alberta/Northwest Territories, Alberta/Saskatchewan, and Saskatchewan/Northwest Territories have been initiated. Discussions between B.C./Alberta, B.C./Yukon, and B.C./Northwest Territories have been postponed at the request of British Columbia.

7. LAKE OF THE WOODS CONTROL BOARD

Objective:

To control and regulate certain major waterways in the Winnipeg River Drainage basin so as to achieve water flow and level conditions that are reasonably acceptable to the various interests.

Duration of Agreement: Continuous. The Board was formed in 1919 under a Dominion Order-in-Council, and was confirmed by federal legislation in 1921 and by Ontario legislation in 1922. At that time, jurisdiction of the natural resources of the four western provinces was vested in Canada, and therefore the member for Canada acted on behalf of Manitoba. Manitoba gained active membership in 1958.

The Board was established under the Lake of the Woods Control Board Act and is reported upon here only because of its association with other water management programs.

Participants and Funding:

Canada - one member  
Ontario - two members  
Manitoba - one member

Canada pays one-third of the Board's annual operating costs in the interest of navigation. The remaining two-thirds is paid by Manitoba and Ontario in the proportion of developed hydropower head in the basin in each province.

Arrangements:

The Board fulfills its responsibilities by directing what the outflows from Lake of the Woods and Lac Seul (and at times the flows diverted from Lake St. Joseph) should be.

To assist it in making its decisions, the Board has traditionally maintained a full-time engineering support group in Ottawa within the Inland Waters/Lands Directorate of Environment Canada. This group was formally established as the Board's Secretariat with the signing of a Memorandum of Understanding in 1981.

To ensure two-way communications with interests within the basin, the Board has recognized a number of specific interest groups, each of which has appointed a representative to the Board. Groups represented include hydropower utilities, pulp and paper industries, native people, cottage owners and tourist outfitters.

The Board holds public meetings each year in the basin to provide detailed information to the public and to obtain feedback on the effects of levels and flows. Also, the Board maintains a phone-in information service to ensure that the public has ready access to information on current conditions in the basin.

Since the Lake of the Woods is an international boundary water, the federal member of the Board serves as Member for Canada on the International Control Boards for Rainy Lake and Lake of the Woods, to ensure coordination with the United States.

Status:

The Board continued to manage the outflows from Lake of the Woods and Lac Seul and kept the public advised of high water levels and hazardous conditions. Apart from direct regulation activities, the Board is continuing to improve its data collection and analysis procedures and has plans to introduce mathematical modelling to assist it in its deliberations.

WATER MANAGEMENT PROGRAMS

1. FRASER RIVER ESTUARY MANAGEMENT PROGRAM

Objective:

To guide economic development while protecting the environment of the Fraser River Estuary.

Duration of Agreement:

October 1985 to December 31, 1990.

Participants and Funding:

A Management Committee Executive has been established representing:  
ENVIRONMENT CANADA  
FISHERIES AND OCEANS CANADA  
MINISTRY OF ENVIRONMENT AND PARKS (B.C.)  
THE FRASER RIVER HARBOUR COMMISSION  
THE NORTH FRASER HARBOUR COMMISSION

The agreed total cost is \$1,250,000; annual costs to be shared equally by the five parties are not to exceed \$250,000.

The Agreement also established a Management Committee with representation from the federal and provincial governments, municipalities, regional districts, port authorities and Indian bands located around the estuary to oversee the implementation of the management program.

Prior Action:

The Fraser River Estuary Management Program is based on a study conducted between 1977 to 1982. The Fraser River Estuary Study examined means to accommodate population and growth while protecting valuable environmental assets of the estuary.

Status:

The Agreement provides for the implementation of several program activities: the coordinated Project Review Process, Activity Programs, a Water Quality Plan, Area Designation, and Public Consultation.

The Standing Committee on the Fraser River Estuary Water Quality Plan has addressed coordination of water quality work in the estuary, and has begun preparation of the Water Quality Plan. Key components of the Plan will be water quality monitoring and the establishment of water quality objectives.

A coordinated interagency referral process is now in formal operation and so is an Environmental Review Committee. Coordination of project review is supported by a computerized central project registry.

Six Activity Programs have developed Terms of Reference and are under way concerned with log management, waste management, emergency management, habitat management, recreation management, and navigation and dredging.

## 2. QU'APPELLE CONVEYANCE AGREEMENT

Objective: To complete the conveyance works begun under the Qu'Appelle Implementation Agreement (1974-1984).

Duration of Agreement: April 1, 1984 to March 31, 1989.

Participants and Funding: CANADA.....\$2 375 000  
SASKATCHEWAN.....\$2 375 000

Status: During the third year of the Agreement, 1986-87, Canada spent \$880 600. The 1986-87 work was predominantly channel improvements on the two Indian reserves immediately upstream of Pasqua Lake and the replacement of a bridge.

## 3. LOWER FRASER VALLEY FLOOD CONTROL

Objectives: To provide protection from flooding of land in the lower reaches of the Fraser River Valley and other areas upstream by rehabilitating existing dykes, constructing new dykes, increasing river bank protection, and improving internal drainage facilities.

Duration of Agreement: 1968 to March 31, 1995 (extended).

Participants and Funding: CANADA.....50%  
BRITISH COLUMBIA.....50%

(Local authorities are responsible for providing construction and access right-of-way.)

In 1974, the federal government increased its contribution to the Flood Control Program and Storage Studies from \$18 000 000 to \$30 500 000 and British Columbia agreed to increase its share by the same amount. In fiscal year 1976-77, both parties agreed to increase the funding to \$60 000 000 for each party, and to extend the Agreement to March 31, 1984. In fiscal year 1983-84, the Agreement was extended to December 31, 1986 with no increase in funds. In fiscal year 1985-86 the Agreement was extended to March 1995 and funding was increased by \$41 million. Total funding committed to the Program by both governments increased to \$161 million.

Status: Construction has been completed at Kent, Matsqui, Surrey (Serpentine-Nicomekl Dams), New Westminster, Coquitlam, Abbotsford, Kamloops (Oak Hills), Surrey-South Westminster, Richmond, Pitt Meadows, Delta, and the Vedder River is nearly complete. Construction was well advanced for the South Dewdney, Pitt Meadows #2, and bank protection at Kent. Final design for Glen Valley was initiated. Estimated expenditures under the program to March 31, 1987 are \$119 000 000. The current annual funding rate is \$2 500 000 from each government.

#### 4. CANADA-ONTARIO AGREEMENT ON GREAT LAKES WATER QUALITY

Objectives: To renew and strengthen cooperation between Canada and Ontario in meeting the obligations under the revised 1978 Canada-U.S. Agreement and to provide for cost-sharing of specific programs which the province will undertake with the federal government in meeting these obligations.

Duration of Agreement: April 1971 to March 31, 1990; agreement renewed in 1976, 1982 and 1986.

An initial agreement from August 1971 to December 31, 1975 authorized \$3 million for feasibility studies and joint sewage treatment technology and urban drainage research. Loans totalling \$250 million for sewage treatment facilities from CMHC and the Ontario Government were also called for in the initial agreement. (Funding for municipal sewage treatment between 1976 and the signing of the new agreement in 1982 was the subject of a separate agreement with CMHC under the National Housing Act.)

The agreement was renewed in March 1976, retroactive to 1 January 1976, as a basis for establishing joint water quality objectives, and to serve to coordinate and implement federal and provincial input to Canadian responsibilities under the international agreement, and to conduct research. This agreement expired on March 31, 1980 but, because a revised agreement was then under negotiation, the 1976 agreement was extended to March 31, 1982, through exchanges of letters between ministers. The agreement was renewed in July 1982 and again on March 6, 1986.

Participants and Funding: CANADA  
ONTARIO

The participants each pay half the cost associated with the research and surveillance programs. For each fiscal year, the total amount payable by Canada shall not exceed an amount to be agreed upon between Canada and Ontario, taking into account:

- (a) the recommendations made by the International Joint Commission relevant to the Great Lakes International Surveillance Plan as developed under the revised Canada-U.S. Agreement;
- (b) the decisions taken, as a result of such recommendations, by the parties to the Canada-U.S. Agreement with respect to such surveillance; and
- (c) the recommendations of the Board of Review.

The renewed agreement provides \$82.1 million for surveillance, upgraded sewage treatment and phosphorous control programs. Each of the governments will contribute \$9.6 million for surveillance to determine concentrations of pollutants in the Great Lakes. In addition, each will give \$1.4 million to a new program to control phosphorus. Special funding in the amount of \$65 million was made available to Ontario for the period 1982-1985 to assist in the completion of municipal sewage facilities construction to meet the requirements of the Canada-U.S. Agreement. This extra funding was formalized under the 1982 Canada-Ontario Agreement. Some \$9.7 million of the original funds were not expended and this amount has been committed over the next two years. Ontario and area municipalities will contribute an additional \$50.4 million to upgrade present sewage treatment facilities or build new ones.

Status:

In February 1981, a joint Canada-U.S. team of scientists began a comprehensive investigation of toxic chemicals in the Niagara River. This joint investigation will make recommendations as to what should be done to reduce or remove the contamination and to monitor the effectiveness of clean-up programs. The final report on this investigation, released in November 1984, contained 24 recommendations pertaining to point source and non-point source control, further investigations and monitoring. A detailed long-term water quality monitoring program was included. A seven point Canada/U.S. proposal, based on this report, is now under consideration.

Because, as already noted, the Canada-Ontario Agreement is being undertaken to provide a basis for implementing the Canada-U.S. Agreement on Great Lakes Water Quality, a brief outline of activities under the latter agreement is also provided.

CANADA-U.S. AGREEMENT ON GREAT LAKES WATER QUALITY

Objectives:

To improve the quality of the water in the areas of the Great Lakes now suffering from pollution; to ensure that Great Lakes water quality will be protected in the future; and to restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes Basin Ecosystem.

Duration of Agreement:

Continuous since April 1972; revised Agreement signed November 22, 1978.

Participants:

CANADA  
UNITED STATES

Commitment:

The concept of the Great Lakes basin and its human resources as an ecosystem is explicitly recognized in the new Agreement. Numerical water quality objectives for some 40 compounds have been specified. Approximately 99 percent of the sewered population on the Canadian side of the basin is now served by adequate municipal wastewater treatment facilities. Programs to control and prevent pollution from industrial sources entering the Great Lakes System have been designed and are being implemented. A commitment has been made to eliminate the discharge of toxic substances into the Great Lakes. New interim phosphorus loading targets, defined for each lake, are designed to achieve desirable levels of water quality. Binational negotiations to ratify the loading targets and reach agreement on Canadian and U.S. programs to meet these targets were partially completed in 1983.

Arrangement:

The International Joint Commission was given primary responsibility for overseeing implementation of this international water quality Agreement. The Commission has established a number of Boards and Committees to carry out the various provisions of the Agreement. Activities are carried out under four programs: Objectives Development, Controls, Assessment, and Special Projects (including toxics, eutrophication, health hazards, etc.).

Status:

Canada and Ontario have agreed to proceed with the implementation of a Phosphorus Control Supplement as recommended under Annex III of the 1978 Agreement. The Control Supplement agreed to on October 16, 1983 includes measures to both protect the upper Great Lakes and further reduce phosphorus discharges to the lower Great Lakes. The Agreement ratifies

the phosphorus loading targets and allocates the residual load reductions to Lake Erie between the United States and Canada. Negotiations continue to similarly allocate the load reductions to Lake Ontario.

The 1978 Agreement is to be reviewed following receipt and examination of the IJC's third biennial report. This report is expected to be presented to the governments of Canada and the U.S. in the spring of 1987. The review of the Agreement by the two federal governments will be undertaken, as in the past, in full consultation with the Provinces of Ontario and Quebec and the eight Great Lakes States. During the latter part of 1985, the Royal Society of Canada and the U.S. National Academy of Science jointly reviewed the progress by the jurisdictions in implementing the 1978 Agreement. This joint report will be most helpful in the forthcoming review by the governments.

## 5. SOUTH SASKATCHEWAN RIVER BASIN STUDY

Objective: To develop a framework plan to guide long term water resources development in the South Saskatchewan River basin.

Duration of Agreement: May 1986 to December 31, 1989.

Participants and Funding: CANADA.....\$800 000  
SASKATCHEWAN.....\$800 000

Status: A study office with director and staff has been established in Moose Jaw (July 1986). An advisory committee of senior provincial and federal public servants has been active in revising study office work plans and program proposals (framework plan formulation and the objectives of the public information program) that were developed by the study office and federal-provincial technical committees. A detailed (1987) work plan includes the application of water quantity, quality and use models for the basin and, as well, field work and in-house analysis to determine the need for future modelling and data collection.

## FLOOD DAMAGE REDUCTION PROGRAM

### 1. FLOOD DAMAGE REDUCTION IN THE TOWN OF RICHMOND (QUEBEC)

Objective: To reduce the damages caused by flooding of the Saint François within the Town of Richmond, Quebec.

Duration of Agreement: May 1984 to March 1987.

Participants and Funding: CANADA.....\$1 966 500  
QUEBEC.....\$2 403 500

Prior Action: Joint studies conducted in 1983-84 demonstrated the feasibility of corrective measures.

Status: The Canada-Quebec Agreement was signed on May 14, 1984, permitting the construction of a pumping station and a dyke, channel work in Cushion Creek and management of the internal drainage network. The total cost of the project rose to \$3.7 million, of which \$1.7 million was the federal share.

## 2. CANADA-MANITOBA FLOOD PROTECTION PROJECTS

Objective: To increase the level of protection afforded by ring dykes in the Red River Valley communities of Rosenort, Morris, St. Adolphe, Dominion City, Emerson, St. Jean Baptiste, Latellier and Brunkild and to provide protection to the community of Ste. Rose du Lac and the water treatment facility at Souris.

Duration: March 10, 1983 to March 31, 1989

Participants and Funding: CANADA.....\$2 745 000  
MANITOBA.....\$3 355 000

Prior Action: Between 1967 and 1971 Canada and Manitoba cooperated in the construction of dykes around seven Red River basin towns that had suffered damages during the 1950 flood and again in 1966. Subsequent experience demonstrated, most recently in 1979, that the dykes constructed under the 1967 agreement did not provide a sufficient margin of safety, nor did they meet the standards of the Canada-Manitoba Flood Damage Reduction Agreement signed in 1976. Thus, a new agreement was signed to upgrade the seven ring dykes which were jointly built earlier, as well as an eighth dyke, around Brunkild, which had been built and fully paid for by Manitoba.

Status: The agreement was signed on March 10, 1983, and a committee was formed to administer it. The agreement was amended in May 1985 to include the construction of a dyke at Ste. Rose du Lac and the upgrading of the dyke at the water treatment plant at Souris with additional funding of \$1 600 000. The earthwork and permanent pumping facilities have been completed at Brunkild, Rosenort, Letellier, St. Jean Baptiste and Morris. Some upgrading has been completed at Emerson and St. Adolphe. The communication/storage facility in Morris was completed and the emergency pumps for the communities on the west side of the Red River were purchased. The communication towers for all communities were constructed.

## 3. MILLE ILES FLOOD CONTROL STRUCTURE

Objective: To reduce the level of flood damage along the Rivière des Mille Iles in Montreal Region.

Duration: December 1983 to March 1987.

Participants and Funding: CANADA.....\$5.9 million  
QUEBEC.....\$7.2 million

Prior Action: Studies to determine the feasibility of a flood control structure on the Rivière des Mille Iles were conducted under the Agreement Respecting Dykes and Flow Regulation Works - Montreal Region.

Status: The Canada-Quebec Agreement was signed on December 10, 1983. The regulation dam was operational by December 1985 and completed in 1986.

The Ministers agreed in August 1985 to reallocate funds already in the agreement so as to increase funding for studies from \$30 000 to \$230 000; these studies are directed towards improving the conditions favouring regulation of the control structure. By March 31, 1987, total expenditures are expected to amount to \$8.9 million, of which the federal share will be \$4 million.

COOPERATIVE ARRANGEMENTS FUNDED FROM SOURCES OTHER THAN THE CANADA WATER ACT

1. REGINA-MOOSE JAW WATER TREATMENT FACILITY

Objective: To improve the water supply available to Regina and Moose Jaw by the construction of a granular activated carbon water filtration plant at Buffalo Pound Lake in Saskatchewan.

Participants and Funding: CANADA  
SASKATCHEWAN

Canada made a federal contribution of \$5 million under an ERDA Subsidiary Agreement towards the total cost of \$15 million.

Status: Construction was completed on schedule and the treatment plant was opened officially in June 1985. The associated carbon regeneration furnace commenced operation in November 1985 and the waste disposal lagoon was completed during the summer 1986. A consultant examined a two-week taste and odour problem that developed in the water in August 1986. The results are being used in a design proposal to expand the capacity of the water supply systems.

2. PORT AUX BASQUES WATER IMPROVEMENTS

Objective: To improve the water supply available to the Town of Channel-Port aux Basques.

Participants and Funding: Canada.....\$6 500 000  
Newfoundland.....\$ 722 000

Canada will pay 90% of the total cost up to a maximum federal contribution of \$6.5 million under an ERDA subsidiary agreement.

Status: Contracts were awarded on the fabrication of a modular package treatment unit and on site preparation/foundation work; a gravity-based auxiliary water supply was nearing completion; a solid waste incinerator was commissioned; and the transmission main and associated roadwork were completed.

During the year, a combined deficit of \$1.8 million occurred when the actual plant cost exceeded the consultant's estimate (\$1.4 million) and the auxiliary water supply works exceeded the target allocations (\$0.4 million) when the first contractor abandoned the project. This has been reduced to \$1.4 million by deleting all non-essential components of the project. At the year end, the town and province were seeking the additional funding.

3. MERCURY IN THE CHURCHILL RIVER DIVERSION SYSTEM

Objectives: To determine the degree to which mercury is present in the Churchill River Diversion system and to identify sources; to study pathways and mechanisms by which mercury moves from water to fish and wildlife through the food chain; to monitor the concentration of mercury in aquatic plants and fish and compare it with available data on the presence of mercury in people living in this area and; where possible, suggest remedies to local mercury problems and means of predicting future occurrences of mercury contamination.



Duration of Agreement: March 1983 to September 1986

Participants and Funding:  
CANADA.....\$380 000  
MANITOBA.....\$380 000

Background: This study arose from concern over increased levels of mercury in fish along the diversion route. Area soils and mineral deposits contain background levels of inorganic mercury which may have been released when the area was flooded. This problem was first addressed under the Northern Flood Agreement that the Department of Indian and Northern Affairs negotiated on behalf of Canada in 1977-78 between Canada, the Province, Manitoba Hydro and the Northern Flood committee (a collectivity of various Indian Bands). An arbitrator, appointed in March 1980 under the terms of the Northern Flood Agreement, to arbitrate claims from any of the four parties concerned, identified the mercury agreement as a priority federal-provincial responsibility.

The Canada-Manitoba Agreement on the Study and Monitoring of Mercury in the Churchill River Diversion was signed on March 10, 1983. The Agreement allows for cost-sharing of expenditures made by Canada and Manitoba retroactive to April 1, 1982. The four year Agreement is scientific in nature and has five broad objectives aimed at improving the knowledge and the ability to respond to mercury problems in northern Manitoba.

Status: Work under this Agreement has progressed well to date with all of the possible 14 projects completed. A four-person Steering Committee and an eight-person Technical Advisory Committee were appointed with an equal number of federal and provincial members. A Study Coordinator provided the necessary management support, coordinated the projects and information, and developed the public awareness component of the Agreement. Annual reports for fiscal years 1983-84 and 1984-85 have been prepared and distributed widely to government and public agencies. A Summary Report and Technical Appendices (four volumes) were submitted to the Ministers of Environment for Canada and Manitoba for approval.

#### 4. CANADA-SASKATCHEWAN IRRIGATION DEVELOPMENT

Objective: To implement a comprehensive economic development program based upon irrigation and related activities.

Duration of Agreement: October 17, 1986 to March 31, 1992

Participants and Funding:  
CANADA.....\$50 000 000  
SASKATCHEWAN.....\$50 000 000

Prior Action: A study completed jointly by Canada and Saskatchewan during 1985 demonstrated that a comprehensive program of economic development based on irrigation will contribute to the economic well being of Canada, Saskatchewan and the region. On June 30, 1986, under the Canada-Saskatchewan Economic and Regional Development Agreement (ERDA), Canada (Agriculture Canada) and Saskatchewan (Saskatchewan Water Corporation) signed a Memorandum of Understanding stating a long-term commitment to activities directed towards comprehensive irrigation-based economic development in Saskatchewan.

Status:

On October 17, 1986, Canada and Saskatchewan signed an agreement to establish a mechanism to promote development studies and proposed works under the Memorandum of Understanding. Activities are divided into three work programs, namely 1) Irrigation Water Supply Development, 2) Economic Development and Support, and 3) Irrigation System Improvements - Southwest Saskatchewan. Under program 1), \$75 000 000 has been targetted towards irrigating by the early 1990s about 12 000 hectares of irrigable land adjacent to Lake Diefenbaker. After the year 2000, about 70 000 hectares have been identified for irrigation development. Program 2) provides \$15 000 000 to facilitate the attainment of maximum benefits from irrigation and related development. Program 3) provides \$10 000 000 to improve and extend existing irrigation works in southwest Saskatchewan. The transfer of ownership and responsibility of operation of 23 storage reservoirs, 7 diversion projects and 6 irrigation projects will be established under separate agreements.

Environment Canada's interest in the new irrigation development under program 1) of the agreement is to ensure that the requirements of the Federal Environmental Assessment and Review Process are met and that the information on basin planning developed as part of the South Saskatchewan River Basin Study is considered in project planning.

Design work on the first phase of program 1), the Luck Lake project on Lake Diefenbaker, has been completed. Construction on this project has been delayed until 1988-89.