Environment Env Canada Car

Environnement Canada

# The Canada Water Act Annual Report 1991-1992

GB 707 C36 1991/92 c. 1

iadä

# <u>NOTE</u>

The fiscal year 1991-1992 will serve as the base year for the updating of future Canada Water Act annual reports. Future reports will be much smaller, reporting only on changes from the base year or previous report. Therefore, the <u>Canada</u> <u>Water Act Annual Report, 1991-1992</u> should be retained for reference. A major comprehensive update of the report is planned once every five years.

### NOTE

L'exercice 1991-1992 servira d'année de référence pour la mise à jour des prochaines éditions du rapport annuel. Celles-ci seront beaucoup plus petites, car le rapport ne portera que sur les changements survenus depuis l'année de référence ou la parution du rapport précédent. C'est pourquoi vous devriez conserver, à titre de référence, le présent <u>Rapport annuel de 1991-1992 - Loi sur les</u> ressources en eau du Canada. Une mise à jour exhaustive du rapport est prévue tous les cinq ans.



Environment Environ Canada Canada

Environnement Canada

# C. C. I. W. LIBRARY

# The Canada Water Act Annual Report 1991-1992

e de la 19 1929 de 1 1938 en 19

.

Printed on paper that contains recovered waste

Published by authority of the Minister of the Environment

© Minister of Supply and Services Canada 1994 Cat. N° En 36-426/1992 ISBN 0-662-61045-8 Deputy Prime Minister and Minister of the Environment



Vice-première ministre et Ministre de l'Environnement

His Excellency The Right Honourable Ramon J. Hnatyshyn, P.C., C.C., C.M.M., C.D., Q.C. Governor General of Canada Rideau Hall Ottawa, Ontario K1A 0A1

Your Excellency:

I respectfully submit to Your Excellency and to the Parliament of Canada the annual report on operations under the <u>Canada Water Act</u> for the fiscal year 1991-1992.

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

Autor

Sheila Copps



Environnement Environment Canada Sous-ministre **Deputy Minister** 



Ottawa, Ontario K1A OH3

Canada

The Honourable Sheila Copps, P.C., M.P. Minister of the Environment Ottawa, Ontario K1A 0A6

Dear Ms. Copps:

I have the honour to submit the Annual Report on operations under the Canada Water Act for the fiscal year 1991-1992.

Yours truly,

Nick Mulder



Printed on recycled paper Imprimé sur du papier recyclé



# Contents

		Page
INTR		1
PROV	ISIONS OF THE CANADA WATER ACT	2
HIGH	LIGHTS 1991-1992	3
PART	I: COMPREHENSIVE WATER RESOURCE MANAGEMENT	5
	Federal-Provincial Cooperation	5
	Interdepartmental Committee on Water	5
	Federal-Provincial Water Resource Management Programs	6
	Regulation, Apportionment, Monitoring and Survey Programs	6
	Water Management Programs	.11
	Flood Damage Reduction Program	12
	Water Research under the Canada Water Act	23
	National Water Research Institute	23
	National Hydrology Research Institute	27
	Water Management Activities	29
PART	II: WATER QUALITY MANAGEMENT	33
PART	IV: PUBLIC INFORMATION PROGRAM	35
PRINC	CIPAL FEDERAL-PROVINCIAL COOPERATIVE ARRANGEMENTS UNDER THE	
		37
	Negulation, Apportionment, Monitoring and Survey Programs	41
	water management Programs	48

# Tables

	· F	Page
Table 1.	Status of Federal and Federal-Provincial Water Management Programs	7
Table 2.	Programs or Studies Completed under the Canada Water Act	9
Table 3.	Designation's to March 31, 1992, under the Flood Damage Reduction Program	17
Table 4.	Flood Damage Reduction Agreements to March 31, 1992	22

## Introduction

The Canada Water Act, proclaimed on September 30, 1970, provides the framework for joint federal-provincial management of Canada's water resources. Section 38 (Revised Statutes of Canada, 1985) 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 twentieth annual report, covers operations to March 31, 1992.

On November 5, 1987, the Federal Water Policy was tabled in Parliament, the culmination of a three-year process which began under the authority of the Canada Water Act. In 1990, the Interdepartmental Committee on Water, itself restructured to serve as the focal point for coordinating the Federal Water Policy, reported to the Minister of the Environment on action under way to implement the provisions of the Policy. A second progress report is scheduled for publication in 1992-93.

Up to and including fiscal year 1975-76, the Canada Water Act funding for federal-provincial projects 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. Subsequent budget reductions and consequent adjustments to the program lowered the ceiling in 1984-85 to \$11 million per year. This total fell to \$9.2 million for 1985-86 and stayed near this level in fiscal years 1986-87, 1987-88, 1988-89, 1989-90, and 1990-91. In 1991-92, a budget of \$7.9 million was established. This budget does not include the federal cost of federal-provincial costshared monitoring and survey agreements (i.e., water quantity and water quality).

In addition to joint federal-provincial undertakings, this report describes other federal activities under the Canada Water Act, including water research, data management, and public information programs.

1

# **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 4) and for cooperative agreements with the provinces to develop and implement plans for the management of water resources (sections 5 to 8). 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. It 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, Regulating Nutrient Inputs, was incorporated into the Canadian Environmental Protection Act

(CEPA) as a result of the Proclamation on June 30, 1988. The Canadian Environmental Protection Act is now responsible for regulating nutrient inputs to Canadian water courses. Information concerning the regulation of nutrients discharge to the aquatic environment will be reported in the CEPA Annual Report to Parliament.

The revocation of Part III of the Canada Water Act subsequent to the 1985 Statutes has no effect on the other Parts or sections unless specifically mentioned. Therefore, Part IV remains Part IV.

Part IV of the Canada Water Act contains provisions for its general administration. In addition, Part IV 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.

# **Highlights 1991-1992**

Improved science, a strong commitment to environmental citizenship and more authoritative information are all important means of enhancing environmental decision-making.

### - Canada's Green Plan

This year's highlights report on a new database, ENVIRODAT, which will be a useful tool to the scientific community; contributions made toward environmental citizenship; and activities related to water export legislation. It is evident that water conservation is a goal shared by all levels of government as well as individual Canadians. Significant progress has been achieved in this area, some examples of which are described below. In conclusion, a summary of the report on the federalprovincial South Saskatchewan River Basin Study is given.

### ENVIRODAT

Accurate data and the analysis of the data are the starting point for informed decision-making. To this end, the database ENVIRODAT has been developed. It replaces NAQUADAT, the National Water Quality Database which was designed to store data arising from the measurement of physical and chemical parameters in fresh surface waters within Canada.

ENVIRODAT has a much broader scope of information storage capability than NAQUADAT. It stores new and historical information of the type kept in NAQUADAT, as well as chemical, physical and biological data from a wide variety of environmental media, e.g., water (fresh, marine, surface, ground), effluents, soils, sediments, and precipitation. The storage of quality assurance/ quality control information related to environmental monitoring programs will also be possible within ENVIRODAT. ENVIRODAT is listed in the table of databases on page 31.

### WATER EXPORT LEGISLATION

In 1991, following renewed interest in proposals for export of freshwater by ship from British Columbia, the federal Interdepartmental Committee on Water began to review the terms of an earlier attempt to legislate restrictions on water export. Bill C-156, the Canada Water Preservation Act, died shortly after being tabled in 1988 when the general election was called. Consultation continued into 1992 among departments and with provinces on the desirability of proceeding once again with legislation to reinforce federal policy on this issue.

### WATER CONSERVATION

### **At Federal Facilities**

The Interdepartmental Advisory Group on Water Conservation at Federal Facilities is making progress on a plan for water conservation at federal facilities. A series of audits of 12 federal facilities has established that there is a significant potential for water efficiency. Substantial immediate reductions in water use result in significant cost savings and an early return of the retrofit costs — often less than two years. The goal is to put the proposed measures into practice at these audited facilities in 1992-93 and to develop a longer-term financing mechanism in parallel with the innovative approaches being developed for energy conservation.

### In Municipalities

Environment Canada, the Canadian Water and Wastewater Association, and the Rawson Academy of Aquatic Science are preparing a water rate setting manual for Canadian municipalities. The project involves the development of a simple and practical manual and computer program that could be used by Canadian municipalities to set water rates conforming to the Federal Water Policy and Green Plan goals of wise water use. The manual will

3

set forth a modified form of marginal cost pricing rather that the flat and declining block rates typical of current municipal rate setting practices. It is scheduled for release in 1992-93.

### **By Canadians**

A series of brochures intended for the general public has been published to encourage Canadians to use water wisely. They outline how to conduct a water audit in the home, suggest water-saving devices, and describe how to conserve water while cooking, cleaning and gardening. Details are given on page 35.

Changing individual action is the key to environmental change.

- Canada's Green Plan

### SOUTH SASKATCHEWAN RIVER BASIN STUDY REPORT

The South Saskatchewan Basin Study Final Report was released in September 1991. The study area, a

complex ecosystem, is the portion of the South Saskatchewan River Basin that lies in Saskatchewan and includes all lands that drain into the river.

The report offers over 40 conclusions and recommendations in such areas as public water management, and research. It concludes overall that the waters of the basin are well managed and recommends that future management practices should adapt to changing conditions. The report recognizes the importance and benefits of water conservation and recommends appropriate development in shoreline areas and investigation of the feasibility of developing regional water supply systems.

The governments of Canada and Saskatchewan, through Environment Canada (under the Canada Water Act) and the Saskatchewan Water Corporation, initiated the \$1.6 million study in 1986 to address concerns about the future availability of water in the South Saskatchewan Basin. Preliminary discussions have been held between Canada and Saskatchewan regarding development of an Implementation Agreement to ensure that the study recommendations are implemented.

# 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 section 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. Implementation of planning recommendations occurs on a federal, provincial, and federal-provincial basis. Cost-sharing of the construction of works 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 provide advice on all federal water programs. Following a review of its mandate in 1987, the Committee was restructured and given a new direction in support of the Federal Water Policy.

Committee membership comprises the nine departments which have a significant interest in freshwater: Agriculture Canada; Energy, Mines and Resources Canada; Environment Canada; External Affairs Canada; Fisheries and Oceans Canada; Health and Welfare Canada; Indian and Northern Affairs Canada; Industry, Science and Technology Canada; and Transport Canada. Environment Canada chairs and provides the Secretariat of the Committee.

In keeping with its advisory role in the development, coordination and implementation of federal policies on freshwater, much of the Committee's activity involves proposed legislative and policy initiatives. In early 1991, the Committee took on the responsibility of overseeing the implementation of the Federal Water Policy on Wetland Conservation. The Committee will also review Great Lakes Remedial Action Plans.

The Committee has been designated in the Federal Water Policy as having the responsibility to monitor and advise the Minister of the Environment on the Policy's delivery. The Committee's first progress report, released in March 1990, recommended that the federal government:

- Increase federal research in support of the development of economic instruments in consultation with the provinces
- Strengthen federal research programs with better integration of natural and social sciences and linkages with external research partners
- Develop alternatives for the Supply and Services Canada Unsolicited Proposal program and Environment Canada's Water Resources Research Support program
- Improve data integration and monitoring, particularly in the North
- Develop a coordinated groundwater strategy
- Implement a federal program to address persistent aquatic debris
- Increase use of the Interdepartmental Committee on Water to enhance integrated federal decisionmaking with respect to water-related policies and programs
- Encourage national and provincial round tables
- Proceed with legislative initiatives in support of the Federal Water Policy (integration of the principles of sustainable development,

ecosystem water management, fair value for water)

- Implement a federally coordinated water awareness program
- Amend the Interdepartmental Committee on Water reporting time frame for Federal Water Policy implementation to every two years.

The Interdepartmental Committee on Water has scheduled publication of the second Progress Report on the Federal Water Policy for the spring of 1993.

### FEDERAL-PROVINCIAL WATER RESOURCE MANAGEMENT PROGRAMS

Table 1 shows a breakdown of current cost-shared federal-provincial water management programs and indicates the stage they have 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 that are projected to continue into the foreseeable future without termination.

### Water Quantity Data Collection

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 a variety of informal arrangements with the provinces. In 1964, 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 under Memoranda of Agreement with Indian and Northern Affairs Canada for the territories.

The 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.

Data from 3483 active hydrometric stations were published and are contained in the national data bank HYDAT, which also has data for 4277 discontinued stations. Of the active stations, 2654 are operated by the federal government, 341 are operated and contributed by the Province of Quebec, 179 by other provinces, and 45 by other agencies.

Under the terms of the agreements, Canada is responsible for maintaining the computer database and for publishing the data. Recent improvements include the use of CD-ROM to disseminate data and improved software for computer access. Water quantity data are essential to good water management and for the design and operation of bridges, dams, drainage facilities, and water supply works across the country. Ready access to reliable data is also essential to monitor and manage any adverse impact of development on the quality of the environment and to plan properly for sustainable development. The efficiency of the data collection program is enhanced significantly by network planning activities, by using standardized methodology, and by providing interpretative information that facilitates the application of the data for many users. To ensure that the data provided to the user are of the highest quality and precision, a quality assurance program is used to monitor methods and procedures in field surveys and office automated computations against established national standards.

### Hydrometric Modernization

Project 2000 is an initiative to modernize data collection associated with the hydrometric survey.

Table 1. Status of Federal and Federal-Provincial Water Management Programs

### Regulation, Apportionment, Monitoring and Survey Programs

### **Under Negotiation**

#### New During 1991-92

Water quality monitoring agreements with Saskatchewan, Nova Scotia, Ontario, and Alberta

Amendment to Master Agreement on Apportionment with Manitoba, Saskatchewan and Alberta (Prairie Provinces Water Board)

### Under Negotiation

Mackenzie River Basin Master Agreement

Study Agreement on Red and Assiniboine rivers

Agreement Respecting Water Resource Management with Newfoundland Extension of the Canada-Ontario

Agreement on Great Lakes Water Quality

### Under Negotiation

Initial agreement with Yukon Territory

Renewed General/Mapping Agreement with Newfoundland Extension of General, Mapping and Studies, and Floodplain Measures

Agreements with Saskatchewan

### Water Management Programs

#### New During 1991-92

Studies on Water Resource Management for Economic Development in New Brunswick Study Agreement on Peace, Athabasca and Slave rivers (Northern Rivers Study) Renewed Fraser River Estuary Management Program Mackenzie River Basin General Agreement

### Flood Damage Reduction Program

#### New During 1991-92

Revised General and Maintenance agreements with Nova Scotia

#### Ongoing During 1991-92

Water quantity surveys with all provinces

Prairie Provinces Water Board Mackenzie River Basin Committee

Water quality monitoring

agreements with Quebec, British Columbia, Newfoundland, New Brunswick, Manitoba and Prince Edward Island

Lake of the Woods Control Board\* Ottawa River Regulation Planning Board

Water quality monitoring agreements with Northwest Territories and Yukon

### Ongoing During 1991-92

Yukon and Alsek River Basins Implementation Agreement Saskatchewan Irrigation Development † Lower Fraser Valley Flood Control Qu'Appelle Conveyance

Fraser River Estuary Management Program

Studies on Water Resource Management for Economic Development in Prince Edward Island

### Ongoing During 1991-92

General Agreement with Northwest Territories, Newfoundland

General/mapping agreements with Quebec) Ontario," Manitoba, Saskatchewan, Alberta, and British Columbia

General and Combined Mapping/ Studies agreements with New Brunswick

Flood Forecasting agreement with New Brunswick

- Memorandum of Understanding on Indian Lands
- Studies agreements with Manitoba and Saskatchewan

Agreement with Saskatchewan on Community Floodplain Management Measures

Established under the Lake of the Woods Control Board Act.

- 1 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.
- \*\* Flood Damage Reduction Agreement with Ontario includes a component for other measures.

Note: For convenience of presentation, some agreements have been separated into categories (general, mapping, studies). Often, they are combined.

7

The aim is to put in place by the year 2000 up-to-date technological infrastructure for more effective monitoring of Canada's water resources.

Features include equipping 80% instead of the current 25% of the stations with the potential to collect real-time data and improved quality assurance to ensure that modernization does not affect the integrity of the data. A three-year pilot study involving approximately 100 stations in Alberta began in 1991-92. During 1991-92 development continued on COMPUMOD, a software system for use by hydrometric technologists throughout Canada. The software is being developed under contract by private industry.

Project 2000 will build upon the data collection platforms (DCPs) installed during the 1980s at remote hydrometric sites in order to permit real-time acquisition of hydrometric data via satellites. The DCPs have enabled more efficient service to clients for real-time data needs such as navigation, reservoir operation, water allocation, and flood forecasting. Specifications have been developed for new digital recorders called EDAS units (Electronic Data Acquisition Systems), which will operate in Canada's climate extremes with hydro and solar power and have satellite and land line communications. These units will permit the recording of data from water quantity, quality and meteorological sensors.

Currently, data from the DCP network are being retrieved directly from the GOES system of satellites via three Direct Readout Ground Stations (DRGS) incorporated into the Water Resources Branch (WRB) computer network of the Inland Waters Directorate, Environment Canada. The three DRGS are located in Vancouver, Downsview, and Gatineau. The stations operated jointly with the Atmospheric are Environment Service (AES). During 1991-1992 plans were developed to use the AES Meteorological Information Service (AMIS) rather than DRGS for distributing the DCP data directly into Inland Waters Directorate regional offices. This service uses the Telesat ANIK satellite. The transition from DRGS to AMIS is scheduled for completion in September 1992.

### Water Quality Monitoring Agreements

Water quality monitoring provides the basis for identifying contamination in the aquatic environment, assessing compliance with regulatory requirements and recommending environmentally sound resource management practices. Environment Canada operates a national water quality monitoring program. Federal-provincial agreements provide the basis for data sharing in British Columbia, Manitoba, New Brunswick, Newfoundland, Quebec, and Prince Edward Island. Water quality monitoring agreements have been negotiated with the two territories. Similar arrangements will be made in Nova Scotia. As well, Environment Canada is prepared to negotiate agreements with Alberta, Saskatchewan, and Ontario.

### N.W.T. Nahanni Water Quality Monitoring Program

This four-year joint study, which was carried out under a Memorandum of Understanding between the Canadian Parks Service and the Conservation and Protection Service of Environment Canada, was concluded with a publication entitled "Protecting the Waters of Nahanni National Park Reserve, N.W.T." The report provides details of the study and recommends short- and long-term water quality objectives for streams flowing into the Park so that the existing pristine conditions are maintained together with an integrated multi-media monitoring program to ensure compliance.

### Prairie Provinces Water Board

The Prairie Provinces Water Board (PPWB), a federal-provincial board that 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. In 1991-92, the Board completed discussions to amend the Master Agreement on Apportionment to define more clearly its role and responsibilities in interprovincial water quality management. A new schedule on water guality has been added to the Master Agreement

Peace-Athabasca Delta Planning Qu'Appelle River Basin Planning	1972 1972
Saskatchewan-Nelson Basin Planning	1973
Okanagan Basin Planning	1974
Saint John Basin Planning	1975
Lake Winnipeg, Churchill and Nelson Rivers Planning Great Lakes Shore Damage Survey	1975 1975
Fraser River Upstream Storage Planning	1976
Churchill River Basin Flaming (Saskatchewan-Manitoba) Montreal Region Flow Regulation Planning Study	1976
Peace-Athabasca Delta Implementation	1976
Northern Ontario Water Resources Planning	1978
Southeastern New Brunswick Dyking Implementation	1978
Suris Basin Planning	1978
Metropolitan Toronto Flood Control Implementation	1978
Lower Saskatchewan Basin Preplanning	1979
Southwestern Ontario Dyking Implementation	1979
Upper Thames Flood Control Implementation Yukon Basin Preplanning	1979
Ottawa River Regulation Planning Support	1980
Thompson Basin Preplanning	1981
Great Lakes Shore Damage Survey Implementation Dykes and Flow Regulation Works - Montreal Region	1981 1981
Mackenzie Basin Planning	1982
Shubenacadie-Stewiacke Basin Planning Ottewie Biver Weter Ouelity Report	1982
Okanagan Basin Implementation	1982
Prairie Provinces Water Board Water Demand Study	1983
North Shore (St. Lawrence) Ecological Inventories Winter River Preplanning	1983 1983
Wabigoon-English Mercury Contamination Study	1984
Flood Prevention within the City of Quebec	1984
Fraser River Estuary Planning	1984
Regulation Works - Montreal Region	1984
Waterford Urban Hydrology Study	1985
Yukon River Basin Planning	1986
Mercury in Churchill River Diversion System	1986
Winter River Basin Planning Flood Damage Reduction in the Town of Richmond (Quebec)	1987 1987
Mille Iles River Flood Control Works	1989
Manitoba Flood Forecasting Agreement	1989
Manitoba Flood Protection Projects	1991
South Saskatchewan River Basin Study	1991
Qu'Appelle Conveyance Agreement Canada-P.E.L. Arrangement Respecting Water Management for	1992
Economic Development	1992
New Brunswick Flood Forecasting Agreement	1992

Schedule E), and submitted to the appropriate governments for approval.

The Board's Committee on Hydrology has developed procedures for natural flow determination for apportionment purposes. The Committee also evaluates the effect that proposed projects might have on the balance of interprovincial waters. In addition, the Board's Committees on Water Quality and Groundwater provide technical advice on interprovincial matters involving water quality and groundwater. A four-year study of historic and current water demands in the three Prairie provinces was completed in December 1982 and is updated every few years.

The Board publishes an annual report of its activities. It has also published six fact sheets which describe the Board's activities as well as a brochure on water use trends in the Saskatchewan-Nelson Basin. For these publications or other information, please contact:

Prairie Provinces Water Board 201 - 2050 Cornwall Street Regina, Saskatchewan S4P 2K5

### Mackenzie River Basin Committee

The Mackenzie River Basin Committee has been reconstituted under a new general agreement signed on September 30, 1991. This agreement gives full status membership to the Northwest Territories and the Yukon. The other members represent Canada (Environment Canada, Indian and Northern Affairs Canada, and Transport Canada), British Columbia, Alberta and Saskatchewan. The Committee is working on the development and negotiation of a Master Cooperative Interjurisdictional Water Management Agreement for the basin. The proposed Agreement will contain broad principles for cooperative water management, a dispute resolution mechanism, and seven bilateral subagreements between adjacent jurisdictions, and will establish a permanent Mackenzie Basin Water Management Board to administer the terms of the Agreement.

### Ottawa River Regulation Planning Board

The Ottawa River Regulation Planning Board has a mandate to plan and recommend criteria for regulating the Ottawa River, looking into account hydropower production, flood protection, navigation, low water problems, water quality needs, and recreation. Studies are 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. Each year the Board publishes a report on its activities.

### Garrison Diversion Studies

The Garrison Joint Technical Committee meets annually to investigate and assess Canadian technical concerns regarding the Garrison diversion project and its potential impact on Canadian waters. In October 1991, the Committee met to examine the current status of plans related to municipal and industrial water supply systems, and the U.S. Army Corps of Engineers studies on Devils Lake, North Dakota. Some of the proposed water supply systems could have transboundary impacts in Canada and there are concerns that the Devils Lake project could introduce saline water into the Red River. In addition, the introduction of Missouri River water into the Devils Lake basin would result in the transfer of foreign biota to the Hudson Bay Drainage basin. Environment Canada continues to monitor the proposals through its membership and secretarial duties on the Committee.

### Lake of the Woods Control Board

The Lake of the Woods Control Board continued to regulate certain waterways in the Winnipeg River basin to balance the requirements of the various and sometimes conflicting interests that depend on 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. It publishes a report on its activities annually.

### Water Management Programs

Depending upon the nature of the work being conducted, water management programs can fall within any of three stages - preplanning studies, planning studies or implementation activities. During 1991-92, two new water management programs were commenced (the Northern Rivers Study and the Canada-New Brunswick Work Sharing Arrangement for Water Resource Management Studies). Several water management programs were continued, including a work-sharing arrangement for water resource management and economic development studies in Prince Edward Island, which expired on March 31, 1992.

**Preplanning Studies:** Preplanning studies are normally done as a result of public representation to resolve one or more problems perceived at the local level. The preplanning study has become the vehicle with which to investigate the concerns expressed. In this type of study, all of the emerging and potential opportunities and problems of the area in question are examined and recommendations concerning the desirability of a longer-term planning study are made.

Planning Studies: A preplanning study may or may not be followed by a planning study. Planning studies generally are directed toward the development or management of the water resources for the social betterment and economic growth of the basin or area under study.

In October 1987, a three-year work-sharing arrangement between Environment Canada and the Prince Edward Island Department of Community and Cultural Affairs was signed respecting the conduct of Studies on Water Resource Management for Economic Development. This agreement, completed on March 31, 1992, was coordinated by a federal-provincial committee, with each party contributing \$500 000. A two-year extension with additional funding of \$200 000 by each party was signed in 1990.

The extended studies included special investigations and demonstration projects related to groundwater resources, inland surface water resources, estuarine water resources, and multi-sectoral and integrated water management.

Under the Green Plan, the federal government announced that it is proposing a joint study with Manitoba and Saskatchewan on water use, sources and effects of pollutants, soil conservation and wildlife habitat in the Red and Assiniboine River basins. Discussions were held with federal agencies and the provinces to identify specific needs and objectives of the proposed study. A survey of water quality is under way in the United States portion of the Red River basin, which offers opportunities to develop a basin-wide perspective on water issues.

A work-sharing arrangement with the Province of New Brunswick Respecting the Conduct of Studies on Water Resource Management for Economic Development was initiated in April 1991. This is a five-year agreement coordinated by a federal-provincial committee, with each party contributing \$1 125 000. The arrangement focuses on the protection of surface and groundwater sources of water supply, the management of estuaries, public education, and economic considerations.

### Northern Rivers Study

Canada, Alberta and the Northwest Territories have commenced a comprehensive multidisciplinary study of the Peace, Athabasca and Slave River basins for the purpose of identifying the potential cumulative water quality impacts of pulp mill and tar sand developments on the aquatic ecosystems of these basins. Participating in this project are Alberta Environment; Alberta Forestry, Lands and Wildlife; Environment Canada; Indian and Northern Affairs Canada; and the N.W.T. Department of Renewable Resources. The study, which will be conducted at a cost of \$12.3 million to be equally shared by Canada and Alberta, is scheduled for completion in 1995.

### Modelling

To ensure sustainable resource development, the application and revision of analytical modelling tools

has been the focus of modelling activities across Canada during 1991-92. Models such as REGUSE are being applied to the Lake of the Woods and St. Croix basins; RIVICE hydraulics are being applied to the St. Lawrence and Nelson rivers; and ONE-D is being applied to the Serpentine-Nicomekl Floodplain Mapping Project. Combinations of numerical models are being used to provide alternative solutions for environmental issues.

Implementation Programs: 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. To implement the study recommendations, a Canada - British Columbia - Yukon Agreement Respecting Water Resource Management and Information Exchange in the Yukon and Alsek River Basins was ratified on March 7, 1991.

An extension has been proposed for the Canada-Ontario Agreement Respecting Great Lakes Water Quality which expired on March 31, 1991. This agreement provided for the cost-sharing of surveillance, research, upgraded sewage treatment, and phosphorus control, reflecting the commitments undertaken by Canada in the 1978 Canada-U.S. Great Lakes Water Quality Agreement. It also re-emphasized the cooperative phosphorus control and Great Lakes surveillance programs and, in accordance with the 1978 Agreement, outlined 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. On November 18, 1987, the parties signed a Protocol amending the 1978 Agreement for the purpose of strengthening programs concerning all sources of toxic substances entering the Great Lakes ecosystem.

An Agreement Respecting a Fraser River Estuary Program was signed in October 1985 by Environment Canada, the Department of Environment of British Columbia, Fisheries and Oceans Canada, the Fraser River Harbour Commission, and the North Fraser Harbour Commission. At an initial annual cost of \$250 000, the program is based on a study conducted between 1977 and 1982. Well into its seventh year of operation, the program is designed to guide economic development while protecting the environment of the estuary. A three-year renewal, with funding of \$600 000 annually and including the Greater Vancouver Regional District as an additional party, was signed on June 1, 1991.

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. The program is designed to improve the channel carrying capacity in restricted areas of the river. The improved channel will convey larger quantities of water with less overbank flooding.

The termination date for the \$4.75 million agreement, cost-shared equally by the two governments, was March 31, 1989. In 1990-91, an extension of the agreement to March 31, 1992, was concluded with additional funding of \$550 000 to be shared equally.

The Canada-British Columbia Fraser River Flood Control program, designed to reduce damages due to floods in the lower Fraser Valley and other areas upstream in British Columbia, continued during the year. Under the program, flood control structures such as dykes are constructed. Some \$145 million of a total joint commitment of \$161 million was spent by the end of March 1992.

### Flood Damage Reduction Program

During 1991-92, the Flood Damage Reduction (FDR) 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 approach taken is to identify flood risk areas and discourage further floodvulnerable development in those areas. Where existing development warrants, remedial measures may be considered.

When joining the program, the provinces sign a General Agreement and a Mapping Agreement (or a combined mapping and studies 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 and provincial disaster assistance will be restricted to structures built before designation and, in some circumstances, for new structures built in accordance with specified floodproofing standards. Local governments and municipalities are encouraged to zone on the basis of FDR flood risk mapping.

Mapping agreements provide for the flood risk mapping and designation of the areas to which the policies in the General Agreement will apply. Forming part of these agreements 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. These agreements also require 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. Under the agreements, pertinent information is provided to government agencies and local authorities for land use planning and zoning purposes. Designations to March 31, 1992, are listed in Table 3 (see page 17).

In some cases existing developments in designated areas will still require protection against flood damages and, for this reason, additional agreements to study such problems can also be negotiated with the provinces and territories. 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, floodproofing, 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, a Studies Agreement was signed with Newfoundland. As well, 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 Floodplain Management Measures agreements with Saskatchewan were signed. In 1987-88, a Floodplain Mapping Agreement was concluded with British Columbia, and amendments to the programs in New Brunswick (General, Mapping, Studies, Forecasting), Newfoundland (General, Mapping, Studies), Quebec (General, Mapping), and Manitoba (Forecasting) were undertaken. In April 1989, a Floodplain Mapping Agreement was concluded with Alberta, During 1989-90, two agreements were extended in Manitoba: the General, Mapping and Studies Agreement and the Agreement Respecting the Construction of Flood Protection Projects. In 1990-91, the mapping component of the Canada-Ontario Agreement Respecting Flood Risk Mapping and Other Flood Damage Reduction Measures was extended by two years. In 1991-92, the General Agreement with Nova Scotia was revised and an Agreement Respecting the Continuance of the Canada-Nova Scotia FDR Program (Maintenance Agreement) was concluded.

**Participants and Funding:** Canada and the provinces share the costs, which are shown in Table 4 (see page 22).

### **Report on Progress**

### Alberta

The Canada-Alberta Flood Risk Mapping Agreement was signed on April 3, 1989. The \$5.5 million in funding of the agreement is to be shared over five years, with the policies of the agreement extending to 1998. Work continued on the mapping of several communities. The community of Fort MacLeod was designated.

### British Columbia

British Columbia and Canada entered into a Floodplain Mapping Agreement on December 3, 1987. The general terms of the agreement extend until 1998, with mapping to be carried out over the first five years at a shared total cost of \$5 million. Under the agreement, 35 floodplain areas in the province, previously mapped under British Columbia's unilateral program, were designated. During 1991-92, nine newly mapped floodplain: were designated, bringing the total number of designations to 62.

Four mapping studies were prepared for designation recommendation to the Ministers. Key plans for the newly designated floodplains were prepared for distribution to federal, provincial and municipal authorities. Discussions were initiated with the province to extend the Mapping Agreement for another five years.

### Manitoba

During 1988-89, Canada and Manitoba negotiated an extension of the General, Mapping, and Studies agreements, with additional funding of \$700 000 (federal share: \$350 000), and provision for the development of a low-cost maintenance phase for the Program. The extension was signed on January 29, 1990. The termination date for the General Agreement is 1999 and for the Mapping and Studies agreements, 1996.

This past year several map sheets for the City of Winnipeg were completed on updated base maps.

Work continued on floodplain management studies for Arborg and Morden.

### New Brunswick

The Flood Forecasting and Mapping and Studies agreements expired March 31, 1992; the General Agreement continues until March 31, 2000. A Continuance Agreement is under discussion.

Base maps and public information maps were completed for the Nashwaak and Magaguadavic rivers. Public information maps have also been prepared for the Sackville and Newcastle areas.

Ice jam flooding occurred in 1991. At Dickey, a concrete and steel bridge was destroyed, a gauging station disabled and the station cableway lost. The station at Ninemile was also damaged by ice. Ice jams also caused widespread damage in the Edmundston and Saint-Basile areas, while water rose to critical levels at Perth-Andover.

### Nova Scotia

General and Continuance agreements were signed on April 1, 1991, comprising the first maintenance agreement to be signed under the FDR Program.

### Newfoundland

Negotiations were completed by federal and provincial officials for a four-year renewal of the mapping and studies programs under the aegis of an umbrella agreement on Water Management.

### Ontario

Fiscal year 1991-92 was the final year for financial expenditures under the FDR Program. The policies of the Agreement, however, will continue for another five years. During 1991-92, the Canada/Ontario FDR Program funded 25 projects. Of these, seven involved flood risk mapping of riverine areas, 17 concerned flood risk mapping of the Great Lakes shoreline, and one involved another FDR measures study. The total expenditures for the fiscal year amounted to \$942 246

shared equally with Ontario. Effective March 31, 1992, the Program had spent all of the \$17.6 million allocation agreed upon in the initial Agreement and subsequent revisions and amendments.

As required by the Amending Agreement No. 2, the Steering Committee prepared an Evaluation Report of the Agreement and submitted it to the Ministers. The evaluation reflected the achievements, direction and feedback received from the user agencies and will be used when negotiations for a maintenance level agreement occur.

The Steering Committee recommended and the Ministers agreed to designate ten additional flood risk areas. The Steering Committee also conducted open houses at 13 centres in preparation for designation. As all the remaining funds of the Agreement are committed, the Steering Committee agreed to recommend designation of the remaining flood risk areas based on the engineering scale maps for the riverine areas and the Conservation Authorities Shoreline Management Plan maps for the Great Lakes shoreline communities.

To date, there have been 64 designations, involving 191 communities and 167 public information map sheets. Currently, work is in progress on behalf of nine Conservation Authorities and four municipalities where no Conservation Authorities exist. (Note: The number of designations and communities designated differs from earlier reports, reflecting revised reporting methods.)

Two studies were completed to document the history of flooding in Ontario. The program revised and completed projects on the regional hydrograph parameter study. Following input from the provincial agencies, technical guidelines for the floodway/ flood fringe delineation were revised, published and distributed. The comprehensive hydrology study for the Black and Severn rivers was completed. Mapping and hydraulics were also completed for the Gravenhurst areas.

The Program funded and completed mapping and analysis of the Burnt River flood risk areas. There are over 340 permanent and seasonal residences in the identified flood risk areas. Prior to its designation, severe flooding occurred in the spring of 1991, inundating over 100 homes in the Sommerville area. Funding was supplied to provide detailed documentation for this flood. Lawsuits are pending in the provincial courts.

In light of the serious flooding and erosion experienced periodically on the Great Lakes shoreline, the mapping of these shorelines has continued to be a high priority for the program. Work continued on acquiring the aerial survey database for topographic mapping of the shoreline. From 1987 to 1989, an aerial survey database was completed for 1200 kilometres of shoreline. The database covers all but 125 kilometres of Lake Ontario shoreline. Initially, eight projects were initiated to develop digitally based topographic maps. These were supplemented by an additional nine projects to cover most of high priority Great Lakes shoreline communities. Work was completed on the digital mapping of 11 of the 17 projects. The outstanding projects which are running behind schedule will be inspected by the Province for completion in 1992-93.

### Quebec

The current agreement concerning mapping and floodplain protection was signed on June 25, 1987. The mapping component expired March 31, 1992. Presently, an extension of the mapping agreement is under negotiation with the Province. The implementation of the intervention policy concerning flood risk areas designated on a final or an interim basis is in force until March 31, 1997. Official exceptions and derogations are provided for exceptional cases and only for certain categories of works identified in the agreement (particular requests concerning municipal facilities among others).

Up to now there are 24 designations for flood risk areas of 222 communities. Hydraulic and hydrologic studies continued in 1991-92.

Flood risk maps for 11 municipalities were submitted to the Ministers for signature. The maps were prepared for communities along the North, Etchemin, Montmorency, Saint-François and St. Lawrence rivers.

### Saskatchewan

The communities of Craven, Fort Qu'Appelle, Lebret and Lumsden were designated. The hydrotechnical study was completed for Tantallon and one initiated for Yorkton. On March 31, 1992, the mapping and studies, and community measures agreements expired. An extension of the mapping and studies agreement has been negotiated.

### Northwest Territories

Daily forecasts of water levels on the Mackenzie River for high flow public notification and navigational use were provided from Yellowknife to 12 users from May to October 1991, under a jointly funded Memorandum of Understanding between the Canadian Coast Guard, and Environment Canada. Transport Canada Improvements to forecasting made during the year included the conversion of the forecast distribution system from Telex to Facsimile; the partial automation of forecast procedures to improve efficiency and reduce program costs; and the development and testing of a flow routing model to increase forecast accuracy during periods of rising water levels. An annual report was presented to the 1992 Western Arctic Athabasca Workshop on January 14, 1992.

Information and advice during spring breakup on real-time river flows and levels was provided to all N.W.T. communities designated under the Flood Damage Reduction Program, in accordance with the procedure established under the Guide to reporting on N.W.T. high-water events.

### Yukon

A proposal for an agreement with the Yukon Territory was deferred.

### Indian Lands

A Memorandum of Understanding between Environment Canada and Indian and Northern Affairs Canada (INAC) was signed in May 1985, to allow interested Indian bands, with the support of INAC regional offices, 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, which was to expire on March 31, 1990, was extended for five more years at the same funding level. Designation, which is intended to restrict flood-prone development in flood risk areas, is not required under this arrangement.

Two Manitoba pilot projects initiated in August 1985 included flood risk mapping of Lizard Point and Sioux Valley Indian reserves. Criteria for selection included the severity of flooding, existing flood-prone development, the need for flood risk information, availability of hydrometric data, past records, aerial photography, and other maps.

These pilot projects have shown that flood risk mapping of thinly populated, widely scattered reserves is prohibitively expensive. Therefore the focus has been changed to historical flood reviews. A historical flood review of Red Earth Indian Reserve in Saskatchewan was completed in 1988-89. A similar study of the Driftpile Indian Reserve in Alberta was completed in 1989-90.

This past year in Ontario, six projects to obtain topographic mapping for the delineation of flood risk areas of the Reserves in southern Ontario were initiated at a cost of about \$76 000. The hydrologic information from earlier studies is being used. The mapping and hydrologic analysis for the Rama Indian Reserve was completed. Work has also begun on the hydrotechnical analysis for a new project to map the flood risk areas in the vicinity of Fox Lake near Chapleau.

In British Columbia, three high-priority Indian Reserves were mapped at a cost of \$150 000, bringing the total to seven reserves. A project for surveying high water marks on the Nass River was also completed.

Location	Number of Communities Merned	Number of Public	Date of
	марроц	information waps	Designation
Alberta			
St. Albert	1	1	January 1991
Cochrane	1	1	January 1991
Medicine Hat	1	1	February 1991
Fort MacLeod	<u> </u>	_1	January 1992
	· · ·		• • •
4 designations	4	4	
British Columbia			
Chilliweck: Vedder Crossing to Slesse Creek			December 1007
Columbia Biver: Columbia-Windermere lakes			December 1987
Columbia River at Golden			December 1987
Columbia River: Windermere Lake-Radium			December 1987
Coguitlam River: Coguitlam Lake-Fraser River			December 1987
Courtenay River			December 1987
Cowichan Lake	•		December 1987
Cowichan and Koksilah rivers at Duncan			December 1987
Eagle River			December 1987
Elk River at Fernie			December 1987
Elk River at Sparwood			December 1987
Kitimat River			December 1987
Kootenay River: Kootenay Lake-U.S. Border			December 1987
North Thompson River: Kamloops-Vavenby			December 1987
Salmon and White rivers			December 1987
Shuswap River: Mara Lake to Mabel Lake			December 1987
Skeena River: Lakelse-Terrace-Usk			December 1987
South Thompson River: Kamloops-Chase			December 1987
Thompson River: Kamloops area			December 1987
Ruiameen River: Coalmont-Julameen		-	December 1987
Columbia River at Revelative			December 1987
Freser and Necheko riverst. Brings Coores			December 1987
Kaslo River at Kaslo			December 1987
Squamish River			December 1987
Goat River			December 1987
Mission Creek			December 1987
Nanaimo River	• •		December 1987
Nechako River at Vanderhoof			December 1987
Bulkley and Telkwa rivers			December 1987
Bulkley River at Houston			December 1987
Cheakamus River			December 1987
Zymoetz (Copper) River			December 1987
Englishman River			December 1987
Vedder River (Vedder Canal to Vedder Crossing)		•	December 1987
Crawford Creek			September 1988
Coquihalla River at Hope			September 1988
Fraser and Quesnel rivers at Quesnel			September 1988
Shawnigan Lake			September 1988
Oyster River			September 1988
Salmon River near Prince George			September 1988
reace kiver			September 1988
Fraser niver near Hope		•	September 1988
MUNICY MUNICE AF88			September 1988

### Table 3. Designations to March 31, 1992, under the Flood Damage Reduction Program

	Number of		
	Communities	Number of Public	Date of
Location	Mapped	Information Maps	Designation
Fik River near Fikford	•**		September 1989
			September 1989
			September 1989
Nicola River Commbell and Ouincom rivers			March 1990
Campbell and Quinsam nvers			March 1990
Beaver Creek			March 1990
			Sentember 1990
			Sentember 1990
Lakelse River and Lake			September 1990
Williams Lake			September 1991
Courtenay, Puntledge and Tsolum rivers			September 1991
Chemainus River	1		September 1991
Seymour River and river arm			September 1991
North and South Alouette rivers			September 1991
Christina Lake*			September 1991
Stuart River and Lake*			September 1991
Salmo River			September 1991
Kootenay River – Columbia Lake			September 1991
<u>Salmon River (Salmon Arm – Spa Creek)</u>			September 1991
62 designations			
Manitoba			
h delite -	1	1	December 1979
	. 1	1	December 1979
wawanesa Méneinen	1	i	February 1980
	1	1	October 1980
Souns	1	1	November 1980
	1	1	March 1982
Brandon	1		November 1982
La Salle/Sanford/Starbuck	3	1	May 1983
Swan River		1	Fébruény 1984
Dauphin	1		lung 1994
Carman	1		Cantanatan 1984
Lorette	1	1	September 1984
Arborg	1	1	November 1987
Fisher Branch	1	. <b>1</b>	November 1987
Riverton		<u>_1</u>	November 1987
	16	14	
16 designations	10	ļ. <del>.</del>	
New Brunswick			· · · · · ·
Fredericton*	10	1 • .	February 1980
Perth/Andover	2	· <b>1</b>	February 1980
Oromocto to Lower Jemsea*	16	1	March 1981
Lower Fredericton to Lincoln*	3	1	February 1982
Euwart	15	1	September 1982
	5	1	March 1983
	2	1	May 1985
Norton*	2	1	March 1986
Walker Brook*	<u> </u>	<u> </u>	
8 designations	55	8	
Newfoundland			
Stephenville *	2	1	June 1984
Steady Brook*	2	1	March 1985
Placentia*	2	1.	March 1986

Table 3. Continued

\*These designations are on a regional or river basin basis and cover a number of municipalities or parts of municipalities

	Number of		_ · ••• · · · · · · · · · · · · · · · ·
	Communities	Number of Public	Date of
Location	Mapped	Information Maps	Designation
Bedger	1	1	March 1986
Rushy Pond	1	1	March 1986
Rushoon	1	1	February 1987
Deer Lake*	4	1	Merch 1988
Parson's Pond	1	1	· May 1989
Waterford River	4	1	May 1989
Stephenville Crossing/Black Duck	2	1	May 1989
Cox's Cove	-	1	Niay 1989 April 1990
Glenwood/Appleton	1	1	April 1990
Giovertown	1		May 1990
Codrov Valley	1	1	May 1990
Bishop's Falls	1	1	Neversher 1990
	1	1	November 1990
<u></u>	<b>–</b>	<b>–</b>	September 1990
16 designations	26	16	
•Nova Scotia			
East River*	5	1	February 1984
Sackville River*	3	1	Fobruary 1984
Antigonish*	2	1	Neuromber 1984
Little Sackville River*		1	November 1984
	5	1	May 1987
<u>,,,,,,,,,</u> ,,,,,,,,,,,,,,,,,,,,,,,,,,,	<u>_</u>	<b>-</b>	March 1988
5 designations	21	5	
Ontario		· · · ·	
White River	1	1	August 1982
Toronto*	16	8	December 1982
Sturgeon River/Lake Nipissing/French River*	15	5	March 1983
Kaministiquia River*	2	1	
Nipigon	1	1	March 1996
Atikokan	1	. 1	March 1996
Grand River*	3	2	March 1997
Maitland Valley*	4	2	March 1987
Nickel District*	9	2	March 1987
Lakefield/North Monaghan	3	33	March 1987
Lower Trent Region*	12	2	March 1987
Goulais River	12	8	March 1987
Espanola		1	August 1987
Thessalon	1	1	August 1987
Little Cataraqui Creek (Kingston)	1		August 1987
Moira River* (Hwy 401 porth to Hwy 7)	ļ.	1	March 1988
Bell Creek (City of Belleville)	5	2	March 1988
Nith River*		1	March 1988
Conestodo River*	5	2	March 1988
Dresden	3	1	March 1988
Hornenavine		1	March 1988
McNab	1	1	August 1988
Patawawa	1	1	October 1988
Moire River (Hum 401 - Rev of Out-to)	1	1	October 1988
	1	1	March 1989
Cooke Creek Cabrellier	3	5	March 1989
A simple Diverse of Lt. L	1	1	May 1989
Agimak Kiver and Lake, Ignace	1	. 1	May 1989
vvabigoon River and Lake, Swanson Creek, Dryden	1	1	May 1989
wississagi River, Iron Bridge	1	1	May 1989
Retue Creek, Port Stanley	1	1	May 1989

Table 3. Continued

	Number of	· ·	
	Communities	Number of Public	Date of
Location	Manned	Information Mans	Designation
	Mapped		Boolgitudori
Otonabee River	1	1	May 1989
Indian River	1	1 · · · ·	May 1989
Ottawa River, Ottawa-Carleton	7	5	May 1989
Gananoque River	5	3.	May 1989
Mississippi River	-	5	May 1989
Raisin Region Conservation Authority streams	12	10	May 1989
Gull River	4	1	July 1989
Muskoka River, Bracebridge	<sup>1</sup> 1	1	August 1989
Lake Ontario shoreline, Toronto	3	3	August 1989
Kebsquasheshing and Nebskwashi rivers.			
Bucciarelli Creek, Chapleau	1	1	January 1990
Lake Huron Shoreline No. 3. Maitland Valley	1	1	January 1990
Mattawichkwia River Hearst	1	1	January 1990
Root River Sault Ste Marie	1	1	January 1990
Wolland River, Early, Black and Beaver creeks	4	4	January 1990
Ottowo Bivos/Howkeebury Greek	3	1	November 1990
	1	1	November 1990
	1	1	March 1991
I hedforde/Klondyke	1		March 1991
Lucan, Crediton and Grand Bend	3	·	March 1991
Credit River*	8	8	March 1991
Ancaster/Sulpher creeks	2	1	March 1991
Upper Bell Creek	· <b>1</b> ·	1	March 1991
Silver/Willow and Spring creeks/Mad River	4	4	March 1991
Rideau River	3	2	March 1991
Elk Lake at James	1	1	March 1991
Big East River at Huntsville	2	1	March 1991
York River at Bancroft	2	. 1	March 1991
Halton Region	5	8	September 1991
Millhaven Creek	1.	1 .	September 1991
Baden Creek	1	1	September 1991
Holland River	2	2	September 1991
Peterborough	1	1	September 1991
Niagara Peninsula	4	4	March 1992
Sauraen Vallev	1	· 1	March 1992
Saugeen valley	1	1	March 1992
Somervile/Burnt NYer		<u> </u>	
64 designations	191	167	
Quebec			
Advantation Providence	29	22	May 1978
	10	8	March 1979
Chaudiere Basin*	19	15	October 1979
Gatineau/Ottawa nvers*	19	10	April 1980
Haut-Richelieu/Baie Missisquoi*	19		
Rivière du Gouffre*	4	2	April 1980
Bas-Richelieu*	23	58	June 1960
Rivière L'Assomption*	12	4	May 1982
Rivière Saint-François*	18	19	October 1982
Rivière Yamaska*	24	30	June 1983
Rivière Bécancour*	4	2	May 1984
Rivière Nicolët*	10	3	May 1984
Fleuve St-Laurent (Trois-Rivières Ouest and Grondines)	2	13	March 1992
Rivière Jacques-Cartier	1	3	March 1990
Rivière Batiscan	1	4	March 1990
Piniàra Malhaia*	2	4	March 1990
Diviàra Liniàra *	2	2	October 1990
	1	6	October 1990
	2	2	March 1991
LIVIELE NOILE	£	-	

Number of				
Location	Communities Mapped	Number of Public	Date of Designation	
Rivière Saint-Charles and tributaries	8	23	March 1991	
Rivière Yamaska Nord	3	8	March 1991	
Rivière Montmorency	1	2	March 1997	
Rivière de Nord	7	34	March 1992	
Bivière Etchemin (at Saint-Léon)	, 1	3	March 1992	
Fleuve Saint-Laurent (at Champlain)	1	<u>8</u>	March 1992 March 1992	
24 designations	222	285		
Saskatchewan				
Fotovon				
	1	1	August 1980	
Pasha Paraéa	1	1	August 1980	
Magaa law	1	1	August 1980	
Melfort	1	1	October 1981	
Padrilla	1	1	April 1988	
	1	1	June 1988	
Tiedele	2	1	October 1989	
Ruffelo Nerrowo	1	1	November 1989	
	1	1	December 1990	
	1	1	December 1990	
North Dettleford	1 .	1	December 1990	
			December 1990	
	1	1	March 1992	
	1	1	March 1992	
	1	1	March 1992	
Lebret	<u>1</u>	<u>_1</u>	March 1992	
16 designations	16	15		
Northwest Territories				
Hay River*	2	1	May 1994	
Fort Simpson	1	1	lune 1995	
Aklavik	1	1	June 1905	
Fort McPherson	1	1	June 1985	
Fort Good Hope	1	1	June 1985	
Fort Liard	1	1	June 1985 Contraction 1007	
Nahanni Butte	1	1	September 1987	
Fort Norman	1	1	September 1987	
Tuktovaktuk	<u>1</u>	<u>1</u>	March 1987	
9 designations	10	9		
Total	561	523		
224 designations				

Table 3. Concluded

		Tabal	
Government/Agency	Duration (years)	l otal Commitment * (dollars)	Expiry Date
Alberta			1009
Flood Damage Reduction Agreement	(general 9) (mapping 5)	5 500 000	1998
British Columbia			
Floodplain Mapping Agreement	(general 10) (menning 5)	5 000 000	1998
Manitoba	(mapping o)	5 000 000	1000
General Agreement	22		1999
Flood Risk Mapping Agreement	19	2 850 000	1996
Studies Agreement	8.5	1 000 000	1989
Construction of Flood Protection Projects	· · · ·		
Agreement	. 7	6 900 000(b)	1991
New Brunswick			
General Agreement	24	-	2000
Flood Risk Mapping Agreement	10	2 000 000	1986
Studies Agreement	15	2 300 000(e)	1992
Flood Damage Reduction - Marsh Creek	6.5	2 010 000(a)	1984
Petitcodiac Sea Dykes Agreement	3 months	160 000	1979
Flood Risk Mapping and Studies Agreement	. 5	710 000	1332
Newfoundland			1005
General Agreement	14	1 470 000	1995
Flood Risk Mapping Agreement	5	480 000	1988
Flood Risk Mapping and Studies Agreement	2	250 000	1990
Nova Occation			
General Agreement	22	•	2000
Flood Risk Mapping Agreement	. 11	1 030 000	1989
Studies Agreement Continuance Agreement (maintenance agreement)	5	250 000	1995
Onterio			
Flood Damage Reduction Agreement	(general 19)	15 400 000	1997
	(mapping 14) (other 14)	2 200 000	1992
Quebec	(concret 21)	10 800 000	1997
Flood Risk Mapping Agreement	(mapping 16)		1992
Dykes and Flow Regulation Works - Montreal Region	7.5	16 056 000(b)	1984
Quebec City Flood Prevention Agreement	. 2	833 000(b) 13 100 000(b)	1985
Mille Iles River Agreement	5.5 3	4 350 000(b)	1987
Saint-François River Agreement - Town of Moninoid		·	
Saskatchewan	20	-	1997
General Agreement Flood Hoverd Menning and Studies Agreement	(mapping 5)	1 300 000	1982
Fluud Hazard Wapping and Ordeles Agreement	(studies 5)	480 000	1982
Flood Hazard Mapping and Studies	(mapping 5) (studies 5)	250 000	1992
Community Floodplain Management Measures	(statios 5/	580 000	1992
Contrainting A roodbient management measures			
Northwest Territories	2	225 000(c)	1978
Memorandum of Understanding General Agreement	14	-	1993
Memorandum of Understanding	14	400,000(a)	1993
	(mapping 9)	400 000(C)	1300
Indian and Northern Affairs Canada			
Memorandum of Understanding Respecting Flood Risk	10	300 000(d)	1995
Mapping of Indian Reserve Lands	Į.		

### Table 4. Flood Damage Reduction Agreements to March 31, 1992

\* 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 Indian and Northern Affairs Canada; (d) maximum annual amount shared equally by Environment Canada and Indian and Northern Affairs Canada; (e) federal share: 1070 \$970 000.

# WATER RESEARCH UNDER THE CANADA WATER ACT

Scientific and socio-economic research, technological development and data collection are essential tools for dealing with the increasing scope and complexity of emerging resource problems.

- Federal Water Policy

Sound management requires a thorough understanding of our water resource and its uses. Scientific research, socio-economic studies and data collection systems all provide the information necessary for good management.

Much of the federal water research is supported by Environment Canada, most of which is carried out by the Inland Waters Directorate (IWD). Here, scientific research conducted by the two IWD research institutes is summarized; hydrogeological studies in the Maritimes are described; highlights of socio-economic studies are presented; and activities related to water data and data management systems are outlined.

### NATIONAL WATER RESEARCH INSTITUTE

The National Water Research Institute (NWRI), located at 867 Lakeshore Road in Burlington, Ontario, 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 are employed by Environment Canada to influence decisions affecting the wise management of our water resources. The Institute's role in Environment Canada is:

- To advise senior management on priority issues
- To provide leadership on rapidly developing or emerging science programs
- To represent Environment Canada in national and international water science organizations
- To provide functional guidance to operational water programs
- To provide expert spokespersons for public discussion of water science issues.

To achieve these goals, NWRI conducts a national, multidisciplinary program of targeted basic research, applied research, and experimental development in the full range of aquatic sciences, and develops research partnerships with the Canadian and international water science communities on priority issues. A number of initiatives have also been undertaken to develop and strengthen the Institute's 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 the Department and externally on behalf of Environment Canada.

Since 1986, the research program at NWRI has been organized into projects conducted by multidisciplinary teams of scientists. Each project focuses on the development of knowledge, expertise and institutional leverage for Environment Canada related to a high priority issue.

The projects are grouped generically under three large multidisciplinary branches - the Lakes Research Branch, the Rivers Research Branch, and the Research and Applications Branch - which are supported by a Research Support Branch and a Program Liaison Unit.

The Institute's current research projects address eight general water research issues. Highlights of the 1991-92 research program are summarized below. NWRI scientists published over 300 journal articles, research contributions and data reports on the scientific aspects of these issues in 1991-92.

### SUMMARY OF RESEARCH PROJECT ACTIVITIES

# Toxic Substances in the Great Lakes and St. Lawrence River Basin

A major long-term research program continued on the sources, pathways, fate and ecosystem effects of organic and inorganic contaminants in the lakes and interconnecting channels of the Great Lakes -St. Lawrence River drainage basin. Critical processes controlling the degradation, volatilization, adsorption and bioaccumulation of contaminants are studied to assess pollution impacts and the feasibility of remedial plans.

Studies comprise both field and laboratory work. For example, the field sampling and processing of water samples and bottom and suspended sediment samples is balanced with intensive analytical laboratory work to detect polychlorinated biphenyls (PCBs), organochlorine compounds, chlorobenzenes, chlorophenols, common biocides, various natural and synthetic tracers and radioisotopes. In addition,

23

studies for methods development are undertaken to improve the speed, efficiency and detection limits of analytical procedures.

Development of the contaminant model TOXFATE continued. This model predicts concentrations of a wide range of contaminants in fish, sediment and water and has been useful in accounting for the fate of toxic contaminant loadings in Lake Ontario. TOXFATE has also been applied to other systems including Lake St.Clair, the Toronto waterfront, and the Niagara and Rhine rivers.

In addition to this modelling work, predictions concerning organochlorine concentrations in fish and other compartments of the food web of Lake Ontario are continuing. An analysis of provincial data showed that if forage fish such as alewifes, smelt, or ciscos are present, the lake trout are about four times more contaminated than in lakes where such forage fish are absent. Similarly, if the freshwater shrimp *Mysis relicta*, an efficient planktivore, is present, trout contaminant levels are also higher.

Ultra-clean sampling, processing and analytical methods have been developed using new facilities installed at the Institute and onboard ship. The resulting protocols were evaluated on open lake samples from Lakes Ontario and Erie. These studies indicate that previously reported levels of trace metals from the surface waters of the Great Lakes have been in error - in some cases by as much as a factor of 100. This has implications not only for our reporting under the Great Lakes Water Quality Agreement but also for our understanding of the cycling of trace metals in the ecosystem. These methods are now being used to examine the open waters of the upper Great Lakes and to measure the concentration of metals in precipitation.

### Lake Restoration

Research continued on the evaluation of remedial options for restoring the ecological integrity and human use of polluted lakes and embayments. This multidisciplinary activity requires the melding together of long-term water quality information with new research results to develop the predictive models needed to select optimal solutions to water quality problems. It is a crucial contribution to the federal-provincial Remedial Action Plan (RAP) development.

Attention continues to be focused on Hamilton Harbour and the Bay of Quinte. Research is also taking place in several other areas, such as Collingwood Harbour, Severn Sound, Spanish River and Toronto Harbour, which have been designated as Areas of Concern by the International Joint Commission.

Water clarity in Hamilton Harbour has improved recently due to reduced phosphorus loadings. Historical water clarity observations were compared with present-day observations to develop a relationship between water clarity and phosphorus loading. Further loading reductions proposed in the Remedial Action Plan can now be evaluated with respect to their expected effect on water clarity.

Organic chemistry plays a central role in the success of many studies in the Areas of Concern. Samples from Hamilton Harbour were analyzed to determine the spatial, temporal and phase distribution of organochlorines. The results show that the loading of PCBs and polyaromatic hydrocarbons (PAHs) from the harbour to Lake Ontario are 10 to 1000 times lower than the loads from the Niagara River.

# Assessment and Remediation of Contaminated Sediments

Previously contaminated bottom sediments are a major source of toxic substances to the overlying waters and biota of lakes. Research is being conducted on the composition and distribution of toxic substances in sediments and on the physical and biogeochemical processes controlling lake sediment-water interactions. The focus is on sediment deposition and resuspension, chemical release rates, microbial degradation, bioaccumulation and toxicity. Results from this work will be used to evaluate the need for and plausibility of remedial measures in the Great Lakes and elsewhere. In addition, the effectiveness of specific remedial techniques such as chemical and biological treatments and *in situ* capping are being studied.

# Assessment of Airborne Toxic Substances and Climate Change Effects on Aquatic Ecosystems

Long range transport and deposition of chemicals to aquatic and terrestrial compartments of the environment is a major cause of environmental pollution. In some parts of Canada, this mechanism represents the most important single source of selected chemicals. The atmosphere is an important sink for some chemicals; it serves as a medium for a continuous cycle of deposition and volatilization of persistent organic contaminants which may ultimately be deposited in the Canadian high Arctic. A detailed understanding of this cycle is needed to quantify the impact that the atmosphere has and will continue to have on the pollution of Canada's surface waters and elsewhere.

The Northern Wetlands Study, which is coordinated by the Institute with the Canadian Institute for Research on Atmospheric Chemicals, has concluded that the Hudson Bay Lowlands only contribute 10% to 40% of the potent greenhouse gas methane to the atmosphere than previously calculated. If this finding is applicable to the more extensive Russian wetlands, other natural and anthropogenic sources of methane are likely to have been underestimated.

Intensive sampling of organochlorine compounds in fresh snowfall and in the snowpack at Mount Bay, N.W.T., has confirmed that only a small percentage of the more volatile compounds remain in the snowpack after deposition. However, PCBs were shown to be effectively trapped in the snowpack.

### Acid Rain

Research into the effects of acid precipitation on lakes, rivers and wetlands is ongoing and with an increasing focus on the effects of nitric acid. Evaluation of critical processes in the acidification and recovery of aquatic ecosystems is undertaken at a variety of sites in eastern Canada. A major collaborative field program with Forestry Canada and the Department of Fisheries and Oceans continues to be conducted at the Turkey Lakes, north of Sault Ste. Marie.

The Institute provides leadership in the assessment of water quality data to verify ecological progress occurring as a result of the implementation of the North American  $SO_2$  emission controls. In addition, the Institute acts as the focal point for information collection and analysis associated with responsibilities arising from the Canada-U.S. Air Quality Agreement and other international cooperative research and monitoring programs.

### Pesticide Assessment

NWRI pesticide research contributes to the development of new analytical methods and knowledge on the occurrence, persistence, fate and ecotoxicological effects of pesticides in lakes and rivers. Increasing emphasis is being placed on community and ecosystem level effects. The information and expertise are used to advise Environment Canada, Agriculture Canada and other federal agencies concerned with pesticide registration, impact assessment, water quality objectives, and environmental surveillance.

### **Groundwater Contamination**

Groundwater research at NWRI focuses on the physical and chemical processes controlling the migration, fate and effects of toxic contaminants in both porous and consolidated aquifers, primarily in eastern and central Canada. Results are used to improve both general and site-specific protocols for aquifer monitoring and decontamination and to develop waste-site rehabilitation plans.

A detailed hydrogeological study of the Guelph-Lockport aquifer in Ontario conducted in cooperation with the Water Centre for Groundwater Research was completed last year. Boreholes were drilled at a field site south of the City of Guelph and tests were conducted to examine the vertical distribution of fracturing and fracture permeability. This information is being used to develop a generalized conceptual model for flow in horizontally stratified fractured media.

Chemical and biological processes influencing the degradation of chlorofluorocarbon-113 (CFC-113), a common groundwater contaminant, were investigated. A laboratory microcosm experiment was conducted to determine rate constants for the metabolism of CFC-113 and the principal metabolites CFC-123a and chlorotrifluoroethene. It was found that CFC-113 degrades very quickly under anaerobic conditions typical in groundwater contaminated by landfill leachate.

Research on the development of expert systems (ES) continued this past year. ES is a special field of artificial intelligence, which is employed in water management for decision-making. It uses a collection of facts, rules of thumb, and other knowledge to help make inferences on how to deal with the water management problem under consideration. One system designed to aid regulatory personnel in determining the potential impact of newly introduced pesticides on typical Canadian groundwater environments has been completed, and the transfer of this software to clients has begun. In addition, the development of an expert system to rank and classify contaminated sites continued.

During 1991-92, a study was concluded to investigate the impact of natural gas seepage on shallow groundwaters in southern Ontario. Samples of soil gas were obtained from sites overlying large regional faults in the western Lake Ontario area and in Essex County in southwestern Ontario. Analysis of soil gas for methane content suggested a deep, basinal origin. Furthermore, in some areas, near the faults, the quality of groundwater may be significantly degraded due to the presence of high concentrations of methane.

A cooperative research agreement has been maintained with the Conservation and Protection Service, Environment Canada, Atlantic Region; the New Brunswick government; and the University of New Brunswick. The Institute will continue its involvement in teaching and research on hydrogeology and groundwater contamination in the Atlantic Region.

### **Assessment of Industrial Effluent Impacts**

The impact assessment of effluents on aquatic ecosystems is complicated by the fact that most of these discharges contain mixtures of organic compounds and metals which have varying degrees of individual and cumulative toxicity. NWRI's research program on pulp and paper mill effluent impacts is successfully addressing this problem. A variety of chemical and ecotoxicological tests have been undertaken to explore the purported link between the extent of chlorination and the effluent's immediate and long-term toxicity. This research is being conducted in partnership with universities, industry and other government departments.

A project on the Athabasca River, which is partially funded by PERD (Panel on Energy Research and Development; Energy, Mines and Resources Canada), is studying the fate, pathways and effects of chemicals released from the exploitation of oil sands. In combination with the PERD project, the Institute has played a major role in the design and initial implementation of studies to address emerging concerns related to the development of pulp and paper mills on the Peace-Athabasca-Slave Basin.

### Aquatic Assessment Methods Development

Improvements in aquatic surveillance, monitoring and assessment programs within Environment Canada are critically dependent on new methods, instruments, protocols and predictive simulation models. A number of studies serve this broad operational need and, at the same time, contribute to the Institute's research on other issues. For example, the following analytical methods and technologies were developed in 1991-92:

- Large-volume sample extractor with solvent recovery system
- A method for the determination of acid volatile sulphide in water sediments using isothermal distillation and electrochemical detection
- A radioimmunoassay for the detection of dioxins
- A laser-excited atomic fluorescence spectrometric method for the direct determination of lead in water
- A method for the determination of resin and fatty acids from sediments at pulp mill sites using supercritical fluid extraction
- A method for the determination of chlorobenzenes and hexachlorobutadiene in sediments using supercritical fluid extraction
- An immunoassay for detection of atrazine in water
- An isochratic anion chromatography method for the determination of organic and inorganic acids in precipitation samples
- An on-line supercritical fluid extraction and derivatization procedure for the determination of pentachlorophenol and related compounds in soil samples
- A UV-longitudinal flow cell for enhanced sensitivity using micellar electrokinetic chromatography in environmental analysis.

Interlaboratory quality assurance studies were completed for the Federal/ Provincial Agreements Program, the Prairie Provinces Water Board, the Long Range Transport of Airborne Pollutants Program, and the National Dioxin Interlaboratory Program. General data quality has been improved through these studies, and problems with data comparability and accuracy quickly identified to responsible managers for corrective action.

# Environmental Information Synthesis and Prediction of Ecosystem Changes

An expert system called RAISON was developed to integrate environmental information from various disciplines and hydrological components. It can be used to enhance our understanding of the ecosystem and for constructing predictive models to forecast environmental impact for different management strategies.

The RAISON System has already had a number of applications. Under a joint federal-provincial study with the Ontario Ministry of Environment (MOE), a query system on drinking water wells was developed for Essex County, Ontario, to access information promptly and to advise on possible causes for such symptoms as odour and taste. The system is being tested by Ontario MOE for other counties. The RAISON System was also applied:

- To the Porcupine River in Ontario, to integrate information on river flow, water chemistry and biological toxicity and to deduce the possible causes of violation of federal and provincial water quality objectives for mine effluent
- To support watershed management and development planning on the synthesis and interpretation of information for both surface and groundwater water quality, river flow, hydrology and fish species for the Oak Ridges Moraine in the Greater Toronto Area
- To delineate basin characteristics such as elevation from grid cell measurements to watersheds in British Columbia.

### NATIONAL HYDROLOGY RESEARCH INSTITUTE

The National Hydrology Research Institute (NHRI) conducts most of its research in western and northern Canada and provides expertise for the Department of the Environment (DOE) on subjects such as the hydrology and ecology of cold regions, climatic change, groundwater issues, modelling of hydrological processes, and the protection and enhancement of Canadian water systems. The Institute has become a recognized national and international leader in the hydrological and aquatic sciences.

The Institute is housed in the National Hydrology Research Centre at Innovation Place, a science park on the University of Saskatchewan campus in Saskatoon. Staff have established many linkages with that university and with other universities in western and central Canada. Institute personnel also collaborate closely with other Saskatoon-based DOE research groups such as the Hydrometeorological Research Division of the Canadian Climate Centre and the Canadian Wildlife Service.

The goals of the Institute are as follows:

- To conduct high-calibre environmental research in support of Canada's Green Plan objectives
- To establish interdisciplinary modes of research
- To continue building national and international partnerships to strengthen its ability to deliver first-class research and expertise
- To communicate knowledge and research results to the scientific community, universities,

students, government departments, and the general public

 To develop effective management strategies to safeguard NHRI's role as a leader in hydrological and aquatic sciences.

In the past year, NHRI has realigned its management and research directions and priorities to address problems and issues delineated in the Green Plan. It has set out its modus operandi in a new strategic plan that clearly defines the links between research activities and Green Plan issues. The goal of this new strategic document is to facilitate development of a progressive research program with an ecosystem emphasis that will address intermediate and long-term environmental issues. Operationally, to address these issues most effectively, NHRI research activities are organized into five projects:

- Climate and Glaciers
- Process Modelling
- Gold Regions Hydrology and Ecology
- Nutrients/Contaminants of Surface Waters
- Groundwater and Contaminants.

### SUMMARY OF RESEARCH PROJECT ACTIVITIES

### **Climate and Glaciers**

Most of the studies in the project on Climate and Glaciers are designed to improve our understanding of the full impacts of global warming on hydrological processes, particularly in mountain environments. Research activities include the development of techniques for use in remote sensing in glaciology, water resource management and climate change studies, as well as the use of long-term records of glacier mass balance, runoff and other meteorological parameters at key representative glaciers to assist in the prediction of future conditions. This past year a new study was begun to assess the environmental impact of a major mining operation in northern British Columbia on water quality/quantity and glacier dynamics.

### Process Modelling

Water management organizations across Canada require good hydrological forecasts for managing and planning water resources. NHRI's research in hydrological modelling is aimed at improving the predictive capabilities of hydrological models at various scales, thereby providing new and alternative approaches to effective management of water resources. This project is made up of 12 separate studies that investigate hydrological processes in various geographic regions and at differing scales: for example, one study evaluates the role of evaporation in semi-arid regions such as the prairies, while another seeks ways to incorporate small-scale process models within larger watershed models for application in cold regions research. Attempts are being made to integrate remotely sensed data into models of hydrological processes with the aim of improving predictions of future supply. An overall objective of this project is to create improved hydrological models capable of simulating the effects of changing climate and land use conditions.

### Cold Regions Hydrology and Ecology

Comprehensive scientific knowledge of the water quantity/quality aspects of northern ecosystems is needed if northern environments are to be protected from the detrimental effects of development. The research carried out by scientists in the Gold Regions Project is designed to enhance knowledge of hydrological, biophysical, chemical, and ecological processes in the North. At a field site between Inuvik and Tuktoyaktuk, a study is addressing hydrological, chemical, and ecological aspects of exchange. The experiment snow-atmosphere measures. turbulent transfer parameters, snow transport from open tundra to the treeline, blowing snow sublimation losses, surface snow water equivalent and concentrations of major anions and cations in accumulating snowcovers over various vegetation/terrain types. Another study is exploring the hydrological and ecological impacts of climate change on northern wetlands, concentrating on the permafrost-hydrologic divides that control water storage within them. In the Mackenzie Delta, work continues on hydrology and ecosystem interactions with the aim of gaining sufficient knowledge about the interactions of hydrologic and biogeochemical processes to develop successful models to predict (1) the effects of global change and (2) the impacts of development in the area.

### Nutrients/Contaminants of Surface Waters

The objective of this research project is to sustain and enhance the integrity, biodiversity and productivity of aquatic ecosystems for future sustainability and environmental health. Aquatic ecologists at NHRI focus their research on the impacts of nutrients and contaminants on aquatic ecosystems and the transfer of these chemical compounds through all levels of the food web. During 1991-92, research activities included a study to quantify the factors controlling the growth of submerged aquatic plants in rivers and to determine their role in the transfer of contaminants through river ecosystems. For example, research was carried out on the suitability of mayflies in the genus Baetis as bioindicators of the environmental quality of prairie river systems; an investigation was conducted into causes of a reproductive failure of lake trout in Crean Lake, Prince Albert National Park; and studies continued into the algal-microbial responses to pulp mill effluents in river ecosystems.

### **Groundwater and Contaminants**

Contamination of groundwater by pesticides is a matter of increasing public and regulatory concern. Several of the studies in this project address this issue, including one that uses an indoor model aquifer facility to test the significance of microbiological processes in pesticide movement and degradation in the subsurface. The model system allows researchers to avoid many of the environmental problems of field testing. In the Abbotsford aguifer on the Fraser River lowland of another pesticide study British Columbia, is investigating the potential for contamination of groundwater resources by 1,2-dichloropropane and nitrates. The past year saw the installation of 15 single and one multilevel piezometer at five sites in the Abbotsford area. Sampling for the contaminants was begun in August. A third study emphasizes flow rates and contaminant transport in clays and tills, an aspect of groundwater research as yet relatively poorly understood. Other research in the project focuses on the environmental impacts of mining, in situ microbial remediation of contaminants, the natural evolution of groundwater chemistry, and the role of groundwater in prairie ecosystems.

### GROUNDWATER CONTAMINATION STUDIES IN NOVA SCOTIA

Environment Canada, in cooperation with Agriculture Canada, is undertaking a five-year program to determine the environmental behaviour of pesticides and nitrates under Atlantic conditions at the Sheffield Research Farm in the Annapolis Valley. This approach is intended:

- To provide interested parties with the needed protocols for evaluating the chemistry and fate of agrochemicals (chemicals used in agricultural industry), particularly as they relate to the new guidelines for the registration of pesticides in Canada, and
- To determine under which agricultural practices particular pesticides and fertilizers can be applied

without causing unacceptable contamination of groundwaters.

During 1991-92, efforts were focused on the collection and analysis of samples of the unsaturated zone (using lysimeters) and of the saturated zone (using piezometers) in a field of corn where the target herbicide was atrazine. This monitoring will continue next year. The fungicide chlorothalonil was similarly monitored in a field of potatoes. Monitoring for background chemistry and groundwater levels will continue throughout the farm.

Other activities this past year included:

- Completion of a study on the water balance of the study site,
- An ongoing modelling study of groundwater in the saturated zone,
- Preliminary work on modelling of pesticides in the unsaturated zone,
- Completion of the evaluation of the soils in the top one metre of the study site, and
- Ongoing monitoring of water levels and precipitation gauges.

Much of this work is being coordinated with the Centre for Water Resources Studies of the Technical University of Nova Scotia in Halifax, the Nova Scotia Department of Environment, the National Hydrology Research Institute, and the National Water Research Institute.

### SOCIO-ECONOMIC STUDIES

The role and visibility of socio-economic studies in Canadian water management grew over the 1991-92 fiscal year, in keeping with the intent of the Federal Water Policy. Substantial progress was made in several areas.

### Water Resource Economics

Progress continued in several areas of economic research which are traditional strengths of water planning and management activities within Environment Canada, such as water pricing, while new initiatives were undertaken in terms of economic studies related to effluent discharge. Some areas of on-going work undertaken in 1991-92 were:

The production of a water rate setting manual and computer model for municipalities in collaboration with the Canadian Water and Wastewater Association and the Rawson Academy of Aquatic Science,

- Empirical studies modelling economic instruments for the control of effluent discharges in the pulp and paper industry of Canada, and
- Collaboration with the International Joint Commission in analyzing economic instruments for the virtual elimination of toxic substances in the Great Lakes.
- A comprehensive review of economic instruments for water management in relation to the federal Green Plan.

Work was also completed on the publication of guidelines for municipal water pricing, a series of papers delivered exploring the relationship between technological change and realistic water pricing, as well as papers on economic instruments and stormwater management, and financing municipal infrastructure through realistic water prices.

### Water Use Studies

The regular survey documenting water use and water pricing in the municipal sector was successfully completed in 1991-92, while the regular survey documenting water use and water cost within the industrial sector commenced in 1991-92, and will be completed in 1992-93. Work also began on data collection related to municipal expenditures and revenues for water infrastructure, with data being collected and analyzed for the provinces of Quebec and Ontario. Reports were published describing municipal water pricing practices (1989) and water use in the industrial sector (1986).

### Water Demand Management and Conservation

Considerable progress toward water conservation in the federal government was achieved with the creation of the Interdepartmental Advisory Group on Water Conservation at Federal Facilities. This advisory group implemented 12 water audits of federal facilities in 1991-92 as part of the development of a water conservation plan for the federal government. Ongoing projects related to the water conservation plan include the development of a water conservation manual for federal facilities and the implementation of the water audit recommendations.

Work also began on the planning and organization of the Water Conservation Conference mandated by the Green Plan, which is expected to be held in February 1993. A collaborative study with the Prairie Provinces Water Board examining the potential for water conservation in rural prairie communities was also done.

### WATER DATA

Programs for the systematic collection and compilation of data on streamflow, water levels, sediment transport, groundwater, 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. These water data are essential for research and sound resource management. In addition to water data collection, there is potential use of hydrometric networks in climate change studies. Another innovation is the collection of background data on water use by municipal and industrial users in Canada. These data are collected in cooperation with the provinces by Environment Canada.

At the National Water Research Institute, 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. At the National Hydrology Research Institute, data collection activities support specific research programs relating to surface and groundwater, and to aquatic ecology. Up-to-date information on glaciers and snow and ice continues to be maintained.

### DATA MANAGEMENT SYSTEMS

Data and information reference systems are essential to research and water resource planning and management. Federal and provincial governments, universities and the private sector depend on this information. The water-related databases and information systems in operation during 1991-92 are listed in the table on page 31.

Water-Related Databases and Information Systems			
Name	Data Provided		
AQUAREF	References to Canadian water resources documents and environment-related articles and reports.		
ENVIRODAT	ENVIRODAT has replaced NAQUADAT (National Water Quality Database). It stores new and historical information of the type kept in NAQUADAT as well as chemical, physical and biological data from a wide variety of environmental media.		
GLSEDS	Great Lakes sediment database with data on physical and chemical properties; samples collected in all lakes during 1968-1978.		
STAR	Limnological data on the Great Lakes.		
MUD and MUP	Data on municipal water and wastewater usage (MUD) and water pricing (MUP) on an individual municipality basis.		
MUNDAT	Information about municipal waterworks and wastewater systems in Canada, compiled in cooperation with provincial governments and the Federation of Associations on the Canadian Environment.		
INUDAT	Industrial water use data for four sectors - manufacturing, mineral extraction, thermal power and hydropower - for over 5000 industrial firms across Canada.		
NAWUDAT	The National Water Use Database is a pilot data storage and retrieval system for Environment Canada's (1986) water use data which covers major industries and municipalities.		
HYDAT	Data on streamflow, water levels, and sediment transport collected through 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.		
HOMS	Inventory and summary description of selected operational techniques and procedures used to collect, process, manipulate and analyze hydrological data for water resources studies. The Hydrological Operational Multipurpose System (HOMS) was developed by the World Meteorological Organization (WMO) for the organized transfer of operational technology used in water resources investigations by member countries of WMO.		
Glacier Data and Information System	Compilation of physical dimensions of Canadian glaciers and a bibliography of Canadian glacier documents.		

NOTE: In the Atlantic Region, a ground water database is being established as a pilot. In 1991-92, software developed the previous year was tested.

# Part II: Water Quality Management

### Canadian Water Quality Guidelines

Water Quality Guidelines are scientifically derived tools used in water resource management. In 1987, the Canadian Council of Resource and Environment Ministers (CCREM) (now called the Canadian Council of Ministers of the Environment) published the first edition of the *Canadian Water Quality Guidelines*. This document, prepared by the CCREM (now CCME) Task Force on Water Quality Guidelines, is a compilation of information on specific water quality parameters that help to determine whether water is suitable for the following major uses: raw water for drinking water supply; recreational water quality and aesthetics; freshwater aquatic life; agricultural uses; and industrial water supplies.

The Guidelines address more than 50 specific substances of concern, including many toxic substances such as heavy metals and pesticides, and are designed to harmonize water quality efforts throughout the country. Associated environmental information for some 120 water quality parameters is also provided. The intent of the Guidelines is to describe the effects of water quality parameters on various water uses and to support the development of site-specific water quality objectives which take local environmental and socio-economic conditions into consideration.

The federal departments of Environment and National Health and Welfare have collaborated to produce a brochure and poster which summarize the *Canadian Water Quality Guidelines* and the *Guidelines for Canadian Drinking Water Quality*, entitled "How Safe Is Our Water?" These publications, which were updated in 1990-91 to cover additional water quality parameters, should prove useful in answering requests concerning human health and environmental aspects of water quality. As well, they are convenient reference material for professionals working in the water field. These publications can be obtained from Environment Canada's Eco-Health Branch in Ottawa, Ontario, K1A 0H3.

### **New Guidelines**

The Task Force on Water Quality Guidelines continues to recommend water quality guidelines for parameters not covered in the 1987 publication, and to update existing guidelines based on newly available scientific information. Guidelines for the pesticides metolachlor, simazine, trifluralin, triallate, dinoseb and captan were published in 1990-91 by the CCME. Water quality guidelines will be published by the CCME in 1992-93 for the following pesticides: aldicarb, bromoxynil, dicamba, diclofop-methyl, and MCPA. Under development are guidelines for clorothalonil, dimethoate, linuron, and tebuthiuron.

The Canadian Environmental Protection Act (CEPA) requires that the Minister of the Environment develop environmental quality quidelines and objectives. The Department of the Environment has begun generating guidelines coincident with assessments of substances on the Priority Substance List under CEPA. Freshwater Quality Guidelines for trichloroethylene and 1,2-dichloroethane were published in 1990-91. Freshwater quality guidelines for some halogenated methanes and some organotins have been developed and published by the CCME. Others under development include aniline, dioxins and furans, methyl tertiarybutyl ether, some phthalate esters, some polycyclic aromatic hydrocarbons, styrene, and tetrachloroethylene.

A protocol for the derivation of Canadian tissue residue (biota) guidelines for the protection of wildlife consumers of aquatic life is under development. Tissue residue guidelines for dioxins and furans will be initiated upon finalization of this protocol. The document "Water Quality Guidelines for Canadian Coastal and Estuarine Waters: Polychlorinated Biphenvls" was published in 1990-91. The report entitled "The Development of Canadian Marine Environmental Quality Guidelines," to be published later in 1992, contains a review of approaches for developing both water and sediment quality guidelines, as well as a compilation of existing marine guidelines from other jurisdictions around the world. CCME has published marine water quality guidelines for organotins. Other marine water quality guidelines under development (if sufficient information is available) include those substances listed above for freshwater.

A protocol for the derivation and use of Canadian sediment quality guidelines is being finalized for review and approval by the CCME. To support the derivation of both freshwater and marine sediment quality guidelines, a database containing information on the biological effects of sediment-associated contaminants is under development. The establishment of this database involves the extensive review and evaluation of sediment toxicity information for various substances, including laboratory studies and field studies involving synoptically collected biological and chemical data.

### **Contaminated Sites Remediation**

In October of 1989, the CCME initiated the National Contaminated Sites Remediation Program. This program has been established:

- To promote a coordinated and nationally consistent approach for the identification, assessment and remediation (cleanup) of the contaminated sites in Canada which impact on human health or the environment or have the potential to do so,
- To provide the necessary government funds to remediate "orphan" sites for which the responsible party cannot be identified or is financially unable to carry out the work, and
- To cooperate with industry to stimulate the development and demonstration of new and innovative remediation technologies.

During 1990-91, Environment Canada, in collaboration with CCME and Health and Welfare Canada, developed the following tools: a National Classification System for contaminated sites and Interim National Environmental Quality Criteria for Contaminated Sites, which contain assessment and remediation criteria for soil and water. During 1991-92, soil toxicity assessments for cadmium, benzene, TCE, PCP and mercury were completed and five new environmental quality criteria for contaminated sites are scheduled to be published in 1992-93 based on these assessments. Other tools developed during 1991-92 for contaminated site assessment include a national guidance document on bioassay techniques for soil, sediment and water; a national framework for ecological risk assessment; and procedures for setting site-specific remediation objectives at contaminated sites. They are scheduled for completion and publication in 1992-93.

Under the latest (1987) revisions to the Great Lakes Water Quality Agreement, the development of objectives for the Great Lakes is clearly a responsibility of the Governments of Canada and the United States. To undertake this task, the Governments established the Binational Objectives Development Committee which, in turn, created the **Ecosystem Objectives Work Group and the Chemical** Objectives Work Group. The initial focus of the former group was on developing Ecosystem Objectives for Lake Ontario, in conjunction with the Lake Ontario Toxics Management Plan. Ecosystem Indicators are now being developed for each of the objectives. The latter group will develop water quality objectives for each lake and, if relevant, tissue levels in fish to protect consumers.

Ecosystem Objectives are developed through public consultation and are basin-wide in scope. They are, in fact, a narrative description of a desirable lake. Ecosystem Indicators consist of scientifically based measurable yardsticks that are publicly reviewed. For Lake Ontario, Ecosystem Objectives were developed in terms of aquatic communities, wildlife, human health, habitat, and stewardship.

# Part IV: Public Information Program

Canada's goal is to develop an environmentally literate society - one where citizens are equipped with the knowledge, skills, and values necessary for action.

- Canada's Green Plan

In order to live again in harmony with the environment, Canadians are voicing the realization that our culture must change. The public information program provides a means for Canadians to look at themselves and their surroundings in new ways, enabling this change. During the past year, an increased number of publications on the environment were targeted to the general public and students.

### **Using Water Wisely**

Canadians waste water. We use, on the average, about 390 litres of water per person, per day – more than twice as much as Europeans. In 1991-92, a series of brochures on the wise use of water in the home were published which explain how to use water more efficiently. They outline how to conduct a water audit in the home, suggest water-saving devices, and describe how to conserve water while cooking, cleaning and gardening.

The "Wise Use of Water" brochures, or bill stuffers, are an excellent example of partnership in action as encouraged in the Green Plan. They contain information supplied and reviewed by both the Regional Municipality of Ottawa-Carleton and Environment Canada. The Canada Communication Group will market the series to other municipalities across Canada while Environment Canada will provide individual copies upon request.

### A Primer on Freshwater - Questions and Answers

In response to requests for information about water that are received daily by Environment Canada, *A Primer on Freshwater* was conceived. The questions were categorized to complement the major issues identified in the Federal Water Policy.

Beginning with the question "What is water?", the Primer answers 128 questions which cover different aspects of water: its physical characteristics; its availability both above and below ground; the uses we make of it; and how we share and manage it. The Primer also contains practical advice on what we, as individuals, can do to help conserve water.

### **Fact Sheets for Everyone**

Up-to-date scientific and socio-economic information on water is necessary for making informed decisions. To fulfill this need, a series of general fact sheets are in progress that describe the hydrologic cycle; state where water is plentiful and where it is scarce in Canada; explain how water quality is determined; compare its industrial, agricultural, domestic and instream uses; and illuminate the role water has played culturally throughout the ages. The most recent fact sheet examines groundwater. (Over six million Canadians rely on groundwater for domestic use.) The fact sheets are well received by students and the general public alike.

To obtain the freshwater series on water or the *Primer on Freshwater: Questions and Answers*, contact:

Environment Canada Enquiry Centre Ottawa, Ontario K1A 0H3 Toll free: 1-800-668-6767

### Water: No Time to Waste

The timely booklet "Water: No Time to Waste, A Consumer's Guide to Water Conservation" stresses the need to conserve water now. It explains that conservation does not mean depriving oneself of water, but rather reducing consumption through judicious use. It suggests that we must reassess our attitudes about water because we cannot assume that there will always be a safe and adequate supply.

This illustrated guide offers practical methods for arriving at solutions. By applying the three golden rules of water conservation - reduce, repair, retrofitin the kitchen, bathroom, utility room, pool and outdoors, water use can be cut by half and consequently household costs will be reduced as well. The underlying theme implies that water can no longer be taken for granted.

Water: No Time to Waste is co-published with the Canada Communication Group and is available at local bookstores across Canada for \$1.95.

### WACE

Educators, librarians, researchers, students and those wanting to learn more about their environment will

soon have access to a bibliography covering materials related to Water Awareness, Communications and Education (WACE). The on-line records are now available through the AQUAREF database and a catalogue which will include bibliographic data, an abstract, and information pertaining to availability of each document, video, etc., is planned for 1992 as part of the Green Plan's Environmental Citizenship Initiative.

Principal Federal-Provincial Cooperative Arrangements under the Canada Water Act

# CONTENTS

Page
------

REGULATION, APPORTIONMENT, MONITORING AND SURVEY PROGRAMS	
1. Water Quantity Survey Agreements	41
2. Water Quality Monitoring Agreements	42
3. Prairie Provinces Water Board	42
4. Ottawa River Regulation Planning Board	44
5. Mackenzie River Basin Committee	45
6. Lake of the Woods Control Board	46
7. Water Resource Management and Information Exchange in the Yukon and Alsek River Basins	47
WATER MANAGEMENT PROGRAMS	
1. Fraser River Estuary Management Program	48
2. Qu'Appelle Conveyance Agreement	49
3. Fraser River Flood Control Program	49
4. Canada-Ontario Agreement Respecting Great Lakes Water Quality	<b>5</b> 0
5. Canada-P.E.I. Arrangement for Water Management	53
6. Canada-N.B. Work Sharing Arrangement Respecting the Conduct of Studies on Water Resource Management for Economic Development	53
7. Canada-Alberta-N.W.T. Agreement Respecting the Peace-Athabasca-Slave River Basin Study, Phase II - Technical Studies	55

## REGULATION, APPORTIONMENT, MONITORING AND SURVEY PROGRAMS

### 1. WATER QUANTITY SURVEY AGREEMENTS

*Objective:* To provide for the operation of a viable and efficient national water quantity survey network; and to define relevant federal and provincial responsibilities.

Duration of Agreements:

Agreements between Canada and each province were signed in 1975 and letters were exchanged between Environment Canada and Indian and Northern Affairs Canada 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.....Environment Canada, and Indian and Northern Affairs Canada representing the Yukon and Northwest Territories BRITISH COLUMBIA.....Ministry of Environment ALBERTA.....Department of Environment SASKATCHEWAN.....Saskatchewan Water Corporation MANITOBA.....Department of Natural Resources ONTARIO.....Ministry of Environment/Ministry of Natural Resources QUEBEC.....Ministere de l'Environment NEW BRUNSWICK.....Department of the Environment NOVA SCOTIA.....Department of Environment PRINCE EDWARD ISLAND.....Department of Environment NEWFOUNDLAND.....Department of Environment and Lands

Arrangements:

Data are gathered, analyzed and interpreted to meet a wide range of client 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. Indian and Northern Affairs Canada transfers funds annually to Environment Canada for the territories' share of costs.

Funding:

1991-92

Total Program Costs\$14 131 400Total Recovered under Agreements6 451 300Total Paid to Quebec under Agreement812 600

"Total Program Costs" are the total shareable program costs of the agreements. The "Total Recovered under Agreements" is the amount paid to Canada by the provinces (Quebec excepted) and by Indian and Northern Affairs Canada. The "Total Paid to Quebec under Agreement" 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.

### 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 and territories.

### Duration of Agreements:

Agreements have been signed with Quebec, British Columbia, Newfoundland, Manitoba, New Brunswick, and Prince Edward Island. 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 and territories will contain similar provisions.

Participants:

CANADA.....Environment Canada BRITISH COLUMBIA.....Ministry of Environment MANITOBA.....Department of Environment QUEBEC.....Ministère de l'Environnement NEW BRUNSWICK.....Department of the Environment PRINCE EDWARD ISLAND.....Department of Environment NEWFOUNDLAND.....Department of Environment and Lands

Arrangements:

In designing the agreements to meet the needs of the federal, territorial and provincial governments, the party(ies) 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 and territorial stations, 100% by the territory; federal-provincial and federal-territorial stations will be funded equally by each party. In 1985-86, Treasury Board authorized the Department to spend up to \$2 139 000 annually to fund agreements.
- Status: Agreements with Quebec became effective in 1983; British Columbia, 1985; Newfoundland, 1986; Manitoba and New Brunswick, 1988; and Prince Edward Island, 1989. Negotiations for agreements with Saskatchewan and Nova Scotia are complete. Negotiations with Alberta, Ontario, Yukon and the Northwest Territories are progressing.

### 3. PRAIRIE PROVINCES WATER BOARD

Objective: The equitable apportionment of eastward flowing interprovincial prairie waters. 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:

Funding: CANADA.....Environment Canada ALBERTA.....Department of the Environment MANITOBA.....Department of Natural Resources SASKATCHEWAN.....Saskatchewan Water Corporation (Funding to be borne one half by Canada and one sixth by each of the provinces.)

### Arrangement:

Schedule C of the Master Agreement on Apportionment provides for the reconstitution of the Prairie Provinces Water Board (PPWB) 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 Committees, and its Secretariat.

The Board, through its Committee on Hydrology, has established procedures for the determination of natural flow for eight interprovincial streams: South Saskatchewan River, North Saskatchewan River, Saskatchewan River, Ou'Appelle River, Churchill River, Battle Creek, Lodge Creek and Middle Creek. Natural flows are calculated for these streams. Procedures for computing natural flow for 20 other small interprovincial streams have been prepared and documented. The procedures will be used when monitoring of apportionment is required for these streams.

In accordance with the Master Agreement on Apportionment, the Water Quality Branch of Environment Canada monitors water quality at 11 interprovincial monitoring sites. These stations are part of the Board's long-term network to monitor water quality in the Prairie provinces. The Board's Committee on Water Quality (COWQ) updated the PPWB Water Quality Contingency Plan developed in 1984 and reported spills and unusual water quality conditions on interjurisdictional streams to the Board and its Member Agencies. The COWQ prepared new PPWB water quality objectives for use at each of the 11 interprovincial river reaches. These new water quality objectives form part of the Water Quality Agreement described later. A report summarizing water quality monitoring results from all 11 stations for the period April 1974 to December 1988 was completed in February 1990. In March 1991, a report entitled "Trend Assessment Techniques: Application to Prairie Provinces Water Board Water Quality Data Set," was produced by the National Water Research Institute. This is an initial report on water quality trends at PPWB monitoring sites.

The Committee's Task Force on Analytical Methodology provides a means of quality assurance and coordinates water quality laboratory results for the Prairie provinces. The Task Force prepared a second report in October 1991 on the comparability of water quality data generated by federal (Environment Canada) and provincial laboratories in the Prairies.

The Board's "fixed term" Committee on Water Quality Policy in 1989 prepared a report and recommended a water quality strategy for the Board. As a result of the Committee's report, the PPWB agreed to amend the Master Agreement on Apportionment to define more clearly the Board's role and responsibilities in interprovincial water quality management. At the end of the year, a PPWB Water Quality Agreement (forming a new schedule to the Master Agreement, Schedule E) had been submitted to governments for approval.

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. A brochure on water use trends in the Saskatchewan-Nelson Basin has also been published by the Board.

The Board's Committee on Groundwater has prepared reports showing cross sections, or profiles, of groundwater conditions along the Alberta-Saskatchewan boundary and the Saskatchewan-Manitoba boundary. The Committee has prepared a report on groundwater-related legislation for the Prairie provinces which responds to potential interprovincial groundwater concerns. In 1991-92, the Committee entered into a contract with the National Hydrology Research Institute to undertake a pilot project to develop criteria for mapping groundwater susceptibility to pollution and map a test area along the Alberta-Saskatchewan boundary using the criteria. A report on the project was completed in March 1991. The Committee also coordinates the tabulation of a bibliography of groundwater reports and data related to interprovincial groundwater evaluations.

With respect to maintaining and updating historical streamflow and natural flow data files for selected hydrometric stations in the Saskatchewan-Nelson Basin, the Secretariat has completed updating its files to 1986. In addition, the Secretariat maintains historical meteorological data including precipitation, gross evaporation and net evaporation for 14 selected sites in the Prairie provinces.

The Board also examines the quantity and quality effects that proposed projects might have on interprovincial streams at the boundaries. The results of each evaluation are reported to the Member Agencies.

### 4. OTTAWA RIVER REGULATION PLANNING BOARD

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

Duration of Agreement:Continuous since March 1983.Participants:CANADA.....Environment Canada, Public Works Canada,<br/>Transport CanadaONTARIO.....Ministry of Natural Resources, Ontario Hydro<br/>OUEBEC.....Ministry of the Environment, Quebec Hydro

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.

44

Status:

A Secretariat within Environment Canada acts 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 Grand Moulin Dam at the upstream end of the Mille lles River.

Subcommittees have been established to study the possibility of using extra 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. MACKENZIE RIVER BASIN COMMITTEE

Objectives:

To exchange information on potential water-related developments in the basin and to recommend to the Ministers studies which would gather data on the basin's water and related resources.

*Duration of Agreement*: Continuous since 1973.

Participants:

CANADA.....Environment Canada, Transport Canada, Indian and Northern Affairs Canada ALBERTA.....Department of the Environment BRITISH COLUMBIA.....Ministry of the Environment SASKATCHEWAN.....Saskatchewan Water Corporation YUKON TERRITORY.....Department of Renewable Resources NORTHWEST TERRITORIES.....Department of Renewable Resources

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 has been reconstituted under a new general agreement signed on September 30, 1991. This agreement gives full status membership to the Northwest Territories and the Yukon Territory.

The Mackenzie River Basin Committee continued to meet during 1991-92 to develop the Master Agreement. By the fall, an Agreement acceptable in principle to Committee members had been formulated. Public consultation followed in Yellowknife on December 9 and 10. Each jurisdiction invited up to ten representatives of stakeholder and interest groups. Aboriginal peoples were well represented. At the workshop a number of recommendations were made to strengthen and improve the Agreement. The Committee has since incorporated many ä

of the recommendations into a new draft, which will be the subject of a second round of public consultations to be held in Edmonton in the spring of 1992. A final draft of the Agreement should be completed by the fall of 1992.

### 6. LAKE OF THE WOODS CONTROL BOARD

### Objective:

To manage the waters of the Lake of the Woods, Lac Seul, and the Winnipeg and English rivers between the outlet of these lakes and their junction. The Board serves diverse interests and tries to achieve water level and flow conditions to meet differing needs.

### Duration of Agreement:

Continuous. The Board was established 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 existence of the Board is required under the terms of the Canada-United States Convention and Protocol of 1925.

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, the remaining two thirds is paid by Manitoba and Ontario in the proportion of developed hydropower head in the basin in each province. (Members are appointed by Orders-in-Council.)

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 maintains an engineering support group in Ottawa within Environment Canada. The support group was formally established as the Board's Secretariat with the signing of a Memorandum of Understanding in 1981.

To ensure two-way communication 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 native peoples, cottage owners, tourist outfitters, municipalities, the pulp and paper industry and hydropower utilities. These representatives provide input to the Board's decisionmaking process.

The Board holds public meetings each year to provide detailed information to the public and to obtain feedback on the effects of levels and flows. A phone-in information service is maintained to ensure that the public has ready access to information on current conditions in the basin. Also available are a brochure on water regulation in the basin and fact sheets on water levels for anyone planning to build a dock.

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 conditions. Apart from direct regulation activities, the Board continues to improve its data collection and analysis procedures. Also, mathematical models are being developed to assist its deliberations.

In recent years, the Board has increased its efforts to ensure that it is appropriately serving its client public. A draft Lake of the Woods Regulation Guide has been prepared and a public consultation process begun to ensure that the interests of all groups are properly reflected. As well, the Board has developed a public communications strategy. The Board began to implement this plan in 1991-92 with the development of a public information display and a new public information pamphlet entitled "Balancing the Interests."

# 7. CANADA - B.C. - YUKON AGREEMENT RESPECTING WATER RESOURCE MANAGEMENT AND INFORMATION EXCHANGE IN THE YUKON AND ALSEK RIVER BASINS

*Objective*: To coordinate ongoing water and related resource planning and management activities through the exchange of information and recommendation of joint studies and investigations.

*Duration*: Effective from March 7, 1991. Continuous until terminated by one of the parties upon serving one year's notice to the other parties.

Participants: CANADA.....Environment Canada, Fisheries and Oceans Canada, Indian and Northern Affairs Canada BRITISH COLUMBIA.....B.C. Ministry of Environment YUKON TERRITORY.....Department of Renewable Resources

Prior Action:

In November 1980, Canada, British Columbia and Yukon entered into An Agreement Respecting Studies and Planning of the Water Resources in the Yukon River Basin. The Yukon River Basin Committee was established and assigned the responsibility for undertaking studies and recommending measures that would lead to the formulation of a planning framework for the Yukon River basin's water resource. In September 1984, the Committee submitted its findings to the participating governments in the *Report on the Yukon River Basin Study*. In March 1986, the governments agreed to support implementation of the recommendations wherever possible.

Status:

The Minister of the Environment for Canada and the Minister of Renewable Resources for Yukon signed the Agreement at a ceremony in Whitehorse on September 7, 1990. All of the remaining signatures were obtained by March 7, 1991. All parties except Fisheries and Oceans Canada have named members to the Yukon and Alsek River Basins Committee; their member is expected to be named in the summer of 1992. Activities under the Agreement are expected to be guided by the recommendations of the Yukon River Basin Study, although the geographic scope is now expanded to include the Canadian portion of the Alsek River basin. These activities are designed to encourage all agencies involved in managing water and related resources in the basins to accept wise use, or conservation, as a guiding principle for future management decisions. In addition, the parties have agreed to encourage, wherever practical, the coordination of water management and land use planning activities, free exchange of information and public participation in the planning process, and early implementation of a range of tasks such as improvement of the daily flow model, and limnological research into the potential effects of regulation on biological productivity in the headwater lakes.

### 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:

June 1, 1991 to March 31, 1994 (renewal of October 1985 Agreement with additional party)

Participants and Funding: An executive Management Committee has been established representing:

CANADA.....Environment Canada, Fisheries and Oceans Canada BRITISH COLUMBIA.....Ministry of Environment

OTHERS.....Fraser River Harbour Commission, North Fraser Harbour Commission, Greater Vancouver Regional District

Under the three-year renewed agreement, the Greater Vancouver Regional District is the latest participating partner and member of the executive Management Committee. The annual costs of this agreement are to be shared equally by the six parties and not to exceed \$600 000.

The advisory committee established by the agreement comprises representatives 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 and 1982. The Fraser River Estuary Study examined means for accommodating a growing population and economy while maintaining the quality and productivity of the Fraser Estuary's natural environment.

The Agreement renews the Agreement signed in October 1985 by Environment Canada, Fisheries and Oceans Canada, British Columbia Environment and Parks, the Fraser River Harbour Commission, and the North Fraser Harbour Commission.

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. Work under the agreement, which was scheduled to expire on December 31, 1990, was extended to May 31, 1991.

Over the past six years, the Fraser River Estuary Management Program has provided the framework for achieving sustainable development in the Fraser River estuary. Accomplishments include the following highlights:

- (1) Implementation of a coordinated referral and review process for all development projects proposed in the estuary. Over 500 proposals for developments have been processed in the past six years to ensure screening by all the appropriate regulatory and management agencies.
- (2) Preparation of a Water Quality Plan for the estuary by a seven-member federal-provincial Standing Committee on Water Quality. The Water Quality Plan will include the mechanism for establishing agreed upon ambient water quality objectives for various reaches of the estuary, a comprehensive monitoring program, and strategies for compliance and enforcement. The Plan was reviewed by the public before it was finalized in late-1991. Under the new agreement, the water quality plan will be implemented, starting in 1992.
- (3) Initiation of a foreshore area designation process involving local governments, federal and provincial agencies and Harbour Commissions.
- (4) Preparation of estuary-wide plans for seven Activity Programs by inter-agency Work Groups. Each work group is chaired by a lead agency and may include representatives from local and senior governments, public interest organizations and industry.

### 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 3	1, 1992	(including	extension)	E

Participants and Funding: CANADA.....Environment Canada SASKATCHEWAN.....Saskatchewan Water Corporation

Status: The total funding for the agreement is \$5 300 000, shared equally between the two levels of government. A total of \$4.48 million (Canada's share \$2.22 million) has been spent to the end of the amended Agreement on March 31, 1992. Works to mitigate the loss of walleye and jackfish spawning habitat have been operational since 1990. A three-year fish population monitoring program, designed to assess the adequacy of the mitigation works, has been completed. At the conclusion of the Agreement in March 1992, the conveyance work was approximately 70% complete. The final section of channel conveyance work remained suspended to the end of the Agreement, pending an agreement between Sask Water and local land owners on the question of irrigation facilities to replace the undesirable earthfill plugs previously used.

### 3. FRASER RIVER FLOOD CONTROL PROGRAM

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 riverbank protection, and improving internal drainage facilities.

Objective:

Duration of Agreement:

Participants and Funding:

### 1968 to March 31, 1995 (including extension).

### CANADA.....Environment Canada BRITISH COLUMBIA.....Ministry of Environment

The agreement provides that each level of government will share the funding equally. (Local authorities are responsible for providing construction and access right-of-way.)

Prior Action:

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 1983-84, the agreement was extended to December 31, 1986, with no increase in funds. In 1985-86, the agreement was extended to March 1995 and funding was increased by \$41 000 000. Total funding committed to the program, shared equally by both governments, is now \$161 000 000.

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, Pitt Meadows No. 2, Delta, Chilliwack, Vedder River, South Dewdney, Glenn Valley, and Mission. Construction is about 80% complete at Coquitlam River. Work is under way at Harrison Hot Springs, and design and environmental studies are being carried out for Boundary Bay Village dykes. Expenditures for 1991-92 were approximately \$600 000 from each government, much reduced from the original budget of \$1 500 000 from each government.

### 4. CANADA-ONTARIO AGREEMENT RESPECTING 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 that the province will undertake with the federal government in meeting these obligations, particularly nearshore surveillance, phosphorus control, and research.

Duration of Agreement: April 1971 to March 31, 1991; agreement renewed in 1976, 1982 and 1986.

Prior Action: 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 the Canada Mortgage and Housing Corporation (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 January 1, 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. On March 31, 1980, this agreement expired, 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. It is anticipated that the agreement will be extended to March 31, 1993, in order for a new agreement to be negotiated. Under this proposed extension, the federal and provincial governments would each provide for a minimum of \$1.87 million annually.

Participants and Funding:

CANADA.....Environment Canada, Fisheries and Oceans Canada, Agriculture Canada

ONTARIO.....Ministry of the Environment, Ministry of Agriculture and Food

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 made, as a result of such recommendations, by the parties to the Canada-U.S. Agreement with respect to such surveillance;
- (c) The recommendations of the Board of Review.

The 1986 agreement, which expired on March 31, 1991, provided \$22.1 million for cost-shared funding on a 50/50 basis for surveillance, research and other activities, and phosphorus control programs. Federal financial assistance for upgraded sewage treatment amounting to \$9.785 million was also provided for in the agreement. Funding for upgraded sewage facilities ended on March 31, 1987.

Status:

In February 1981, a joint Canada-U.S. team of scientists began a comprehensive investigation of toxic substances in the Niagara River. 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. On October 30, 1986, the Niagara River Toxics Management Plan was announced and formalized by the signing of a "Declaration of Intent" in February 1987. In 1987-88, the plan was implemented. Four-party status reports on activities are released on an annual basis.

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. GREAT LAKES WATER QUALITY AGREEMENT

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; amended 1983; 1987 Protocol signed November 1987.

Participants:

CANADA.....Government of Canada UNITED STATES.....Government of the United States of America

### Commitment:

The concept of the Great Lakes basin and its human resources as an ecosystem is explicitly recognized in the 1978 agreement. Numerical water quality objectives for some 40 compounds have been specified. Approximately 99% 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. The 1987 Protocol builds on the existing cooperative efforts of Canada and the United States. It signifies the renewed commitment of the Parties to pursue the objective of virtual elimination of persistent toxic substances from the Great Lakes ecosystem and the philosophy of zero discharge. New provisions cover Areas of Concern; lakewide management plans; contaminated sediments; non-point source pollution; airborne toxics; human health risks; new ecosystem and water quality objectives; and groundwater.

Another significant change resulting from the Protocol is the strengthened public accountability of the Parties. Under the Protocol the Parties are required to report publicly to the International Joint Commission on the progress of implementation of specific annexes.

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.). The 1987 Protocol commits the two governments to coordinate implementation and evaluate progress under the agreement through semi-annual meetings.

Status:

In 1986, Canada and Ontario agreed on 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.

The Parties have developed a binational framework for meeting those coordination requirements as defined in Article 10(3) of the Agreement. As this process evolves it is anticipated that many of the coordination functions traditionally undertaken by the International Joint Commission will be transferred to the binational framework. This transfer of responsibility will allow the Commission to fulfill its mandate better under Article VII, i.e., to review and make recommendations on problems and matters on the "quality of the boundary waters of the Great Lakes Basin Ecosystem...."

The first report of Canada pursuant to the 1987 Protocol for the period ending December 1988 was completed and the second detailing progress in 1989-90 was released in September 1991.

In October 1989, a \$125 million Great Lakes Action Plan was announced by Canada, reconfirming the federal government's commitment to cleaning up the Great Lakes. The Plan consists of three components: Preservation (\$50 million), Cleanup (\$55 million), and Health Effects (\$20 million). The second year of the Plan ended on March 31, 1991.

# 5. CANADA-PRINCE EDWARD ISLAND ARRANGEMENT RESPECTING WATER MANAGEMENT FOR ECONOMIC DEVELOPMENT

Objectives: To evaluate existing water use demands and constraints; to demonstrate means of increasing water's sustainable contribution to economic development on Prince Edward Island; and to identify future development potential in the province's water resources bases, i.e., groundwater, surface water, and estuaries.

Duration: April 1,	1987 to March 31, 1992 (includir	g extension).
--------------------	----------------------------------	---------------

Participants and Funding:

CANADA.....Environment Canada PRINCE EDWARD ISLAND.....Department of Community and Cultural Affairs

The total funding of this program is \$1 400 000, shared equally.

Prior Action:

The arrangement was signed by the Minister of Environment Canada and the Minister of the Prince Edward Island Department of Community and Cultural Affairs on October 26, 1987. On the same date, a Memorandum of Understanding on Conservation and Development between several key federal and provincial government agencies was signed.

An amending agreement to increase the total funding to \$1.4 million (from \$1.0 million) and extend the expiry date by two years to March 31, 1992, was signed by the Ministers in November 1990.

Status:

The work-shared arrangement deals with key water issues on the Island concerning groundwater, surface water, and estuaries. For example, the groundwater program addressed several problems and included drilling and testing in areas where groundwater availability is limiting economic growth. These studies have been completed and 12 reports published. The results of an assessment of pesticides in groundwater were also published. A report on the introduction of techniques to prevent contamination of individual wells is being used in the development of well drilling regulations for Prince Edward Island. The economic implications of the establishment of groundwater protection zones are being examined. Studies relating nitrate in groundwater to land use and on remedial techniques to remove hydrocarbons from contaminated soil have been completed, with the provincial partners producing reports.

### 6. CANADA – NEW BRUNSWICK WORK SHARING ARRANGEMENT RESPECTING THE CONDUCT OF STUDIES ON WATER RESOURCE MANAGEMENT FOR ECONOMIC DEVELOPMENT

Objectives: To collect and interpret data required to demonstrate water conservation and protection techniques, and to recommend ways to maximize the contribution of water to the economic development of New Brunswick in a manner that is environmentally sustainable over the long term.

Duration of Agreement:	April 1, 1991 to March 31, 1996.
Participants and Funding:	CANADAEnvironment Canada

NEW BRUNSWICK.....Department of the Environment

The total funding for the agreement is \$2 250 000, shared equally.

Arrangement: The arrangement was signed by the Regional Director General, Atlantic Region, Conservation and Protection for Environment Canada, and the Deputy Minister for Environment New Brunswick in a Memorandum of Understanding dated April 24, 1991.

The Memorandum of Understanding establishes a Coordinating Committee, comprising an equal number of members from each department, to oversee the arrangement by coordinating work plans and developing appropriate procedures to ensure an equivalence of expenditures by the two governments.

Status:

The work-sharing studies include the examination of estuaries, groundwater contamination and protection, economic considerations, and public education and information as the major initiatives. Some of the work under the estuaries program, such as the Saint John Harbour study, is being carried out in support of the Atlantic Coastal Action Plan (a Green Plan initiative.)

<u>The Estuaries Program</u>: Because of New Brunswick's extensive coastline, estuaries are an important part of the overall water resource. Under the Estuaries Program, studies help determine the degree of contamination of the major estuaries and form the basis of management plans that will prevent further contamination.

Included in this program will be work with the aquaculture industry. In recent years this industry has become a vital part of New Brunswick's economy. However, its growth is putting new pressures on water resources. In response to these pressures, participants will be developing an environmental monitoring program to assess the effect of salmon aquaculture on the marine environment and will also begin to determine the extent of contamination and develop strategies to combat it.

The Water Resources Program: New Brunswick's water comes from two sources: groundwater and surface water. One initiative under the Water Resources Program is to survey and analyze the effects of six different pesticides on groundwater supplies. Another is to promote alternative well construction practices, where feasible. This will involve the development of a groundwater database that will include information on well design, pumping rates and groundwater quality.

The Economic Considerations Program: Clean water in sufficient supply is critical to a strong, healthy economy. Up to now, water has been underpriced and therefore undervalued. There is a need to understand clearly what value New Brunswick residents place on their water resources. To give some indication, a survey has been conducted among the residents of the town of Sackville.

This component of the Agreement is also looking at the economic benefits of such "new" practices as obtaining energy from groundwater, or Aquifer Thermal Energy Storage, as it is more formally referred to. A cost benefit analysis of this energy source for both heating and cooling is already under way.

The Public Information Program: People want to know about the threats to water resources and what they can do to help protect them. Under this program, participants will produce a wide variety of materials to help students and the general public understand the importance of water to their lives and to the economy.

### 7. CANADA-ALBERTA-NORTHWEST TERRITORIES AGREEMENT RESPECTING THE PEACE-ATHABASCA-SLAVE RIVER BASIN STUDY, PHASE II – TECHNICAL STUDIES (NORTHERN RIVERS STUDY)

*Objective*: To understand and characterize the cumulative effects of development on the water and the aquatic environment of the study area by coordinating with existing programs and undertaking appropriate new technical studies.

Duration of Agreement: September 27, 1991 to March 31, 1995.

Participants and Funding: CANADA.....Environment Canada, Indian and Northern Affairs Canada ALBERTA.....Department of the Environment, Department of Forestry, Lands and Wildlife NORTHWEST TERRITORIES.....Department of Renewable Resources

The total funding for this study is \$12 300 000, shared equally. The Study Board will consist of up to 25 members, appointed by Ministers. The following governmental agencies are represented:

Alberta Environment (2 members) Alberta Forestry, Lands and Wildlife Alberta Health Environment Canada Fisheries and Oceans Canada Indian Affairs and Northern Development Canada Health and Welfare Canada GNWT Department of Renewable Resources

Additional members (including non-governmental members) may be appointed by the joint agreement of the Ministers of the Environment for Canada and Alberta, and the Minister of Renewable Resources for the Government of the Northwest Territories.

Arrangement: An Operations Committee (formed mainly from the nucleus of the Study Board) is responsible, among other things, for ensuring that funds are expended in accordance with the legislative requirements of the funding parties.

*Prior Action*: Phase I – Initial Inventory and Data Gap Evaluation of the Peace-Athabasca-Slave River Basin Study was carried out by an intergovernmental task force.

Status:

A Study Office has been established.