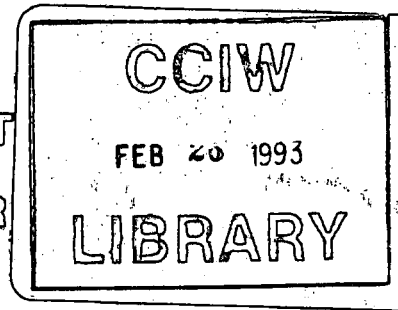


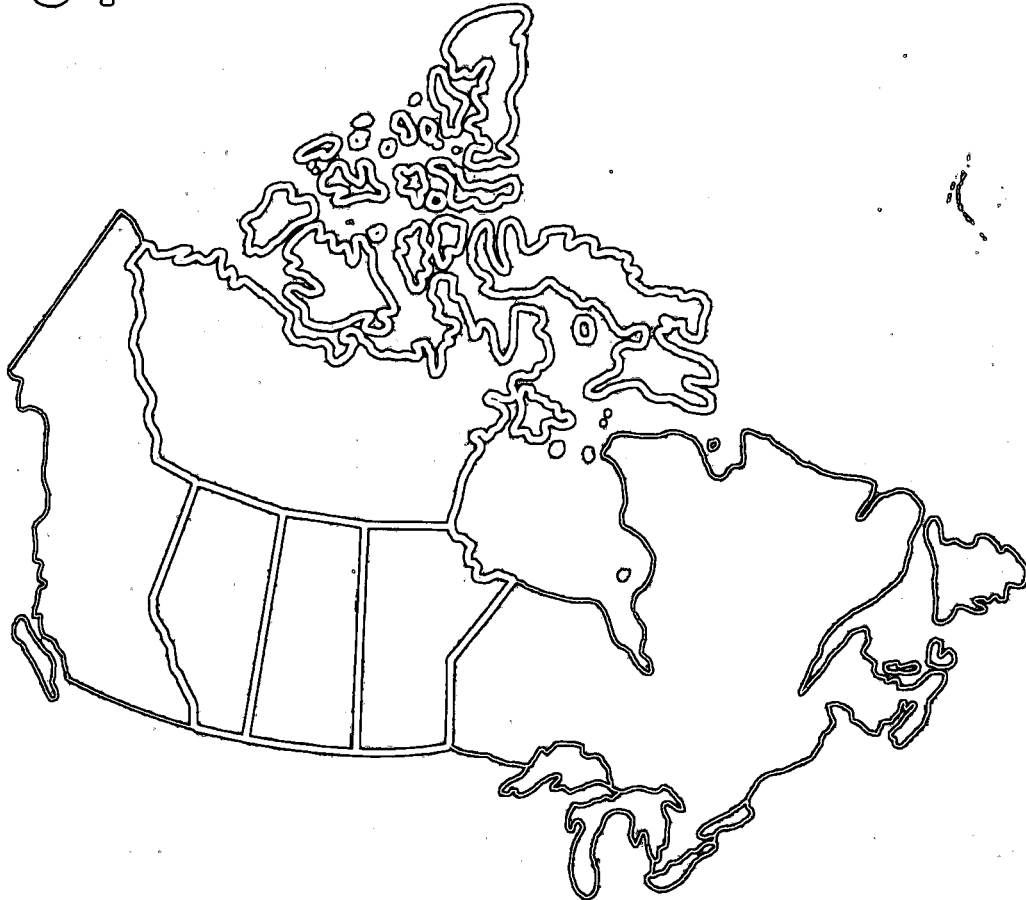
Environment Canada

INLAND WATERS DIRECTORAT  
WESTERN AND NORTHERN R



# ANNUAL REPORT

## 1983-84



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LETTER OF TRANSMITTAL

I am pleased to present the second annual report for the Inland Waters Directorate, Western and Northern Region covering fiscal year 1983-84. This report explains in some detail the major activities and accomplishments of the year and outlines some of the longer term goals and strategies being pursued by the Directorate.

It is hoped that readers of this report will gain a better appreciation of federal water management programs in the Prairie Provinces and the Northwest Territories. Through continued dialogue, we will be better able to develop programs which are responsive to the needs of western and northern Canadians.

*D. A. Davis*

D. A. Davis

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Letter of Transmittal

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## HIGHLIGHTS

During 1983-84, the Inland Waters Directorate, Western and Northern Region, was involved with a number of new initiatives which will affect the course of our activities over the next few years. These include progress on developing a mechanism for managing water resources in the Mackenzie River basin, negotiations with the provinces to develop federal-provincial water quality monitoring agreements, and preparation of background data and information for the Inquiry on Federal Water Policy. Specific highlights for the year are listed below:

**Mackenzie River Basin:** Bilateral discussions between British Columbia and Alberta, and Alberta and the Northwest Territories have been initiated as a first step towards implementation of a mechanism to address transboundary water management issues. Two draft agreements related to an integrated monitoring network and Mackenzie-Liard ice breakup studies have been prepared for review by the Committee.

**Water Quality Agreements:** Negotiations on formal water quality monitoring agreements continued with Alberta, a negotiating team was named for Manitoba, and informal contact was made with Saskatchewan. The agreements will facilitate the collection of water quality data, will help establish compatible data bases, and provide accurate and timely information to managers and the public.

**Alberta Hydrometric Expansion:** The proposed 5 year, 250 gauging station expansion program has been rescheduled over a 9 year period.

**Flood Damage Reduction:** The two communities of Swan River and Dauphin, Manitoba were designated. Designation prohibits federal funding for new development in the floodway and delineates areas which can be developed with appropriate floodproofing measures. Significant progress was made on mapping, hydrologic and hydraulics in other communities.

**New Technology:** The provision of current water level and streamflow data from remote sites was enhanced through the installation of 17 data collection platforms which allow transmission of the data via satellite.

**International Issues:** Negotiations between Canada and the United States on the Garrison Project have reached a critical stage, and a technical committee and four task forces were formed to deal with the issues.

**Mercury in the Churchill River Diversion:** Canada and Manitoba have commenced work on 9 projects related to the study of mercury contamination resulting from the Churchill River diversion.

### 1.0 FAITS SAILLANTS

Au cours des années 1983 et 1984, la Direction générale des eaux intérieures, région de l'Ouest et du Nord, s'est impliqué dans de

nombreux nouveaux projets qui affecteront nos activités au cours des prochaines années. Ces projets comprennent la mise au point d'un mécanisme de gestion des ressources hydrauliques du bassin du fleuve Mackenzie, des négociations avec les provinces visant des ententes fédérales-provinciales sur la surveillance de la qualité des eaux, et la réunion de renseignements et de données documentaires en vue de l'enquête sur les politiques du gouvernement fédéral relatives aux eaux canadiennes. Voici les faits saillants de l'année.

**Bassin du fleuve Mackenzie:** La Colombie-Britannique et l'Alberta ainsi que l'Alberta et les Territoires du Nord-Ouest ont entrepris des discussions bilatérales comme première étape menant à la mise en place d'un mécanisme qui permettra de régler les questions relatives à la gestion des eaux trans-frontalières. On a rédigé deux rapports d'ententes sur un réseau intégré de surveillance et effectué des études sur la débâcle de la rivière Liard et du fleuve Mackenzie pour les soumettre à l'examen du comité.

**Ententes sur la qualité des eaux:** Nous avons poursuivi les négociations avec l'Alberta au sujet d'ententes officielles sur la surveillance de la qualité des eaux, formé un groupe de négociation pour le Manitoba, et établi des contacts officiels avec la Saskatchewan. Ces ententes faciliteront la ceuillette de données sur la qualité des eaux, aideront à l'établissement de bases de données compatibles et fourniront des renseignements exacts et opportuns aux gestionnaires et au grand public.

**Expansion de l'hydrométrie en Alberta:** Le programme quinquennal suggéré portant sur 250 stations de jaugeage a été rééchelonné sur une période de 9 ans.

**Diminution des dommages causés par les inondations:** Les villes de Swan River et de Dauphin (Manitoba) ont été désignées. Cette désignation interdit tout financement fédéral de nouveaux aménagements du canal de dérivation et définit les secteurs où l'on peut prendre les mesures appropriées contre les inondations. D'importants progrès ont été réalisés dans la cartographie et les études hydrologiques et hydrauliques dans les autres collectivités.

**Nouvelle technologie:** La mise en place dans des endroits éloignés de 17 plates-formes qui transmettent des données par satellite a permis d'améliorer les données courantes sur le niveau de l'eau et le débit des cours d'eau.

**Points de discussions internationaux:** Les discussions canada-américaines sur le projet Garrison ont atteint un point critique, et un comité technique et quatre groupes d'étude ont été mis sur pied pour s'occuper du sujet.

**Détournement de la rivière Churchill - taux de mercure:** Le Canada et le Manitoba ont entrepris neuf projets se rattachant à l'étude de la contamination par le mercure causée par le détournement de la rivière Churchill.

## 2.0 INTRODUCTION

The federal government role in water resources management is to ensure that waters of the nation are protected and used "...for the greatest social and economic benefit of Canadians, including both present and future generations." In Canada, the federal government does not have a strong direct mandate for the management of resources. It does however, have certain clearly defined responsibilities and concerns with respect to how the management of resources at the provincial level will reflect on national interests. Most of the activities carried out by Inland Waters Directorate, Western and Northern Region are conducted in close cooperation with the provinces or territories, often under federal-provincial cost sharing agreements.

This report covers the activities of Inland Waters Directorate, Western and Northern Region for the fiscal year ending March 31, 1984. The region encompasses the provinces of Alberta, Saskatchewan, and Manitoba, and the Northwest Territories, with the regional office located in Regina and major district offices in Winnipeg, Regina, Calgary, and Yellowknife. Directorate activities in the region comprise a significant part of Environment Canada's program. The organization chart on the following page illustrates the overall structure of the department and the interrelationship between its various components.

## 3.0 RESOURCES

During 1983-84 the Directorate managed and administered total resources of 13.78 million dollars and 221.3 person-years. These figures include operational funding as well as grants and contributions made under federal-provincial agreements. The following tables display the distribution of these resources by National Program and by Organizational Unit respectively.

### Resource Summary by National Program

NATIONAL PROGRAM No. Name	p/y	1983-84 '000\$
1.1 Interjurisdictional Waters	24.1	1,785.9
1.2 Flood Damage Reduction	7.8	597.5
1.3 Water Quality Management	9.2	850.0
1.4 Water Quantity Management	154.4	9,285.3
1.5 Water Management Research	8.0	478.8
1.6 Management	12.5	613.1
4.1 Toxic Chemicals	3.3	30.0
4.3 Environmental Assessment	2.0	142.7
TOTALS	221.3	13,782.3*

\*figures do not include summer student employment program

## Resource Summary by Organizational Unit

Organizational Unit	p/y	1983-84 '000\$
Regional Management	12.0	536.5
Water Quality	20.4	1,289.8
Water Planning and Management	18.1	1,593.6
WRB, Manitoba	42.0	2,227.6
WRB, Saskatchewan	37.3	1,932.4
WRB, Alberta	50.8	2,772.0
IWD, Northwest Territories	28.2	2,623.1
NWRI	8.0	474.3
PPWB*	4.5	334.0
TOTALS	221.3	13,783.3

\*resources for PPWB are administered by IWD

## 4.0 1983-84 ACTIVITIES

### INTERNATIONAL ACTIVITIES

An accurate determination of natural flow and apportionment of the flow of the Milk River historically has not been made, as it is assumed that United States and Canadian uses generally are less than their respective shares under the Boundary Waters Treaty. However, increasing use in both countries, and the potential for constructing a major storage reservoir in Canada, have resulted in a joint study to derive methods for more accurately determining natural flow at the Eastern Crossing of the International Boundary.

Deficit St. Mary River deliveries were recorded in one-half of the division periods during the irrigation season. The United States requested a delay in refunding early season deficits, which was accommodated by Canada with the provision that it have the option of taking all or part of the delivery in the Milk River. The natural flow of the three Eastern Tributaries of the Milk River, Lodge Creek, Battle Creek, and Frenchman River, were apportioned in accordance with Rule III of the 1921 International Joint Commission Order. All deficits that occurred within individual apportionment periods were refunded by the end of the irrigation season. Flow on the Souris River from Saskatchewan to North Dakota was sufficient to meet Canada's obligations under the interim measures.

Assistance was provided to the Red River Pollution Board concerning monitoring of the Red River, compliance assessments with regard to objectives and upholding Canada's obligations. Canada and Manitoba held discussions concerning the development of a monitoring contingency plan in the event of spills and regarding the formulation of water quality objectives for the Souris River at the International Boundary. The Poplar River at the International Boundary continued to be of

projects underway. A four person Steering Committee and eight person Technical Advisory Committee have been appointed with an equal number of federal and provincial members. A Study Director has been hired to provide the necessary management support, coordination of projects and information, and to develop the public awareness component of the Agreement.

### Flood Damage Reduction

Mapping of most of the priority flood prone areas has been completed under the mapping agreement with Saskatchewan, which expired in 1982. In Saskatchewan, work continued on completing previously authorized studies, in anticipation of an eventual renewal of the mapping agreement. Studies were completed at Saskatoon, Prince Albert, Regina, Lumsden, Tantallon and Carrot River.

A study, completed for Hay River, Northwest Territories, and the application of historical flood level information acquired for other communities in 1982-83 will enable several designation recommendations to be made in 1984-85.

In Manitoba hydrotechnical studies for floodplain mapping were completed for several communities. The communities of Swan River and Dauphin were designated.

### Canada-Manitoba Flood Forecasting Agreement

This \$600 thousand agreement with Manitoba to investigate the improvement of the flood forecasting in the Assiniboine, Red River, and Souris River basins proceeded satisfactorily. Phase I of the study was completed and arrangements were made to proceed with Phase II. The primary objective of Phase II is to apply the HSPF hydrologic model to several tributaries of the three main basins.

### Canada-Manitoba Agreement to Upgrade Ring Dykes

A \$4.5 million CWA agreement with Manitoba was signed in March 1983 to upgrade the level of protection of ring dykes at eight Red River Valley communities to the 1:100 level. Of these communities, construction has begun at St. Adolphe and Brunkild. Negotiations are nearing completion for the expansion of the program to include construction of a dyke at Ste. Rose du Lac, and upgrading a dyke at Souris. An amended agreement to include these works is expected to be signed by the summer of 1984. Work under the Agreement has been delayed because of the inability of the Province to obtain agreements with the communities to cost-share construction and maintenance. Discussions were also finalized with the United States which would allow joint protection of Emerson, Manitoba and Noyes, Minnesota.

### Mackenzie River Basin

In the past year bilateral discussions between Alberta and British Columbia were carried out and discussions between Alberta and Canada for N.W.T. were initiated as a first

step towards implementation of Mackenzie River Basin Committee (MRBC) Study recommendation 1. The MRBC continued preparatory work for implementation of recommendations 2, 5 and 6 and draft implementation agreements have been prepared and are under review. The Yellowknife office participated in the preparation of a detailed multi-year plan for the implementation of MRBC Recommendation 6 (comprehensive Mackenzie Delta studies). MRBC subsequently shelved formal action on Delta activities due to the indefinite postponement of the Liard Hydro project. Work continued, with funding from IWD resources, on the assembly of baseline data for the development of a hydrodynamic model of the Mackenzie Delta.

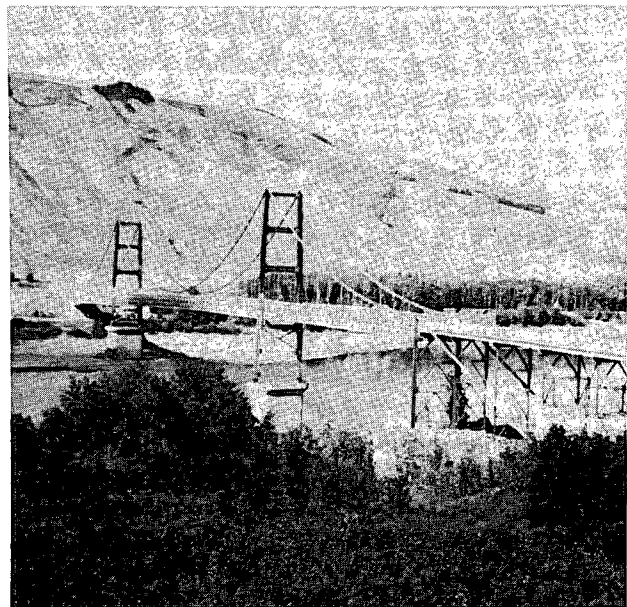
### Implementation

The cities of Regina and Moose Jaw have experienced taste and odour problems with their municipal drinking water supplies for several years. IWD was involved in negotiating a federal-provincial agreement to provide senior government financial assistance for the construction of a granular activated carbon treatment facility to resolve the problems.

### Interjurisdictional Agreements

A cooperative study of interjurisdictional rivers was undertaken with the Government of the Northwest Territories, operating under a Letter of Understanding formalized by the two agencies in 1983/84. Of prime concern are those river basins lying along the NWT - Alberta border. Overview study reports are the end product of the eight identified basins, and the Hay River Basin Overview is near completion.

IWD is also actively participating in negotiations of a proposed series of trans-boundary agreements within the Mackenzie River basin covering the boundary crossing points.



## WATER QUALITY MANAGEMENT

### Water Quality Objectives

Intensive effort continued to be provided to meeting the interprovincial obligations to the Prairie Provinces Water Board and its committees regarding the review and revision of water quality requirements for eleven eastward flowing interprovincial rivers. The focus in the region is on the establishment of federal-provincial objectives on Canada/United States transboundary rivers and the general advocacy of objectives in water quality management schemes. A working group has been proposed, composed of membership from Manitoba, Saskatchewan and Canada (WQB) to consider the formulation of objectives for the Souris River transboundary locations.

### Water Quality Agreements

The federal government is committed to working cooperatively with the provinces in assessing the quality of the water resource. Negotiations continued with Alberta towards formalizing water quality monitoring for the collection of water quality data, to establish compatible data bases and to provide accurate and timely information to managers and the public. A federal-provincial negotiating team has been named for developing a Canada-Manitoba water quality agreement. Informal meetings have already been held and some agreement details discussed on monitoring the Souris River following spills originating in the U.S.A.

Ad hoc sampling and analysis arrangements were negotiated with provincial and federal agencies: two with Saskatchewan Department of Environment; two with Alberta Department of Environment; and, several with agencies of the federal Department of Environment (Parks Canada, Canadian Wildlife Service, National Hydrology Research Institute...).

### Water Quality Monitoring

Monitoring was conducted at 70 locations throughout the region at a regular frequency and for specific chemical, physical and biological characteristics. The monitoring philosophies and strategies continue to be reviewed and refined. A strategy document is being prepared cooperatively with IWD headquarters concerning national water quality assessments and considerable progress was made concerning water quality assessments in the Northwest Territories. During 1983-84 action was taken to reduce routine monitoring, to facilitate the relocation and re-establishment of analytical services at the national and new regional laboratories.

An automatic water quality monitor transmitting data via satellite was operated continuously on the Red River near Emerson, Manitoba. The monitor provided for the continuous real time data for temperature, conductivity, chloride, dissolved oxygen and pH.

## Aquatic Quality Surveys

During the year the Branch continued involvement with the Qu'Appelle Implementation Board through intensive sampling of nutrient inputs and outputs at the Fishing Lakes. Sampling terminated in June as funding for the program was deleted from the provincial budget. A comprehensive report of the four years intensive surveys is now underway. Toxic chemical related surveys were conducted for mercury in the Red River, Manitoba and in Cookson Reservoir, Saskatchewan. A five year toxic chemical plan was prepared and three toxic chemical projects submitted for funding consideration under the federal TOXFUND. Assistance was provided to the Atmospheric Environment Services and the Prairie Provinces regarding the preparation of acid sensitivity maps and the design of surveys to collect additional information for this task.

### Water Quality Interpretation and Reports

During 1983/84 three detailed data reports and eight interpretative reports were prepared by the WQB. Considerable support was provided to headquarters in the preparation and review of several reports. The section on Publications includes reports prepared by WQB during this reporting period.

The report writing and data management capabilities of the Branch were enhanced through computerization. Training was provided to staff on the interpretative software on the Regina computer, VAX 750, and a laboratory management package was developed and implemented. The four regional field offices were upgraded with graphic terminals and access to Regina through a telecommunication network. Overall, the increase of computer use in the WQB program continues to improve operational efficiency and effectiveness.

### Laboratories

The year 1983-84 was a year of significant change and upheaval for the regional laboratory and associated staff. Services from Calgary were relocated to both Burlington, Ontario and Saskatoon, Saskatchewan. The Calgary laboratory moved essentially on schedule to Saskatoon, by December 1983 into modified facilities at the Canadian Wildlife Service, Migratory Birds Centre. This regional laboratory has responsibilities for those parameters which are unstable (nutrients, cyanide, phenols, alkalinity...) and which require analysis more quickly than can be provided if the samples were shipped to Burlington, Ontario where the major analytical responsibilities now reside. At Burlington, analytical services are provided for major ions, and multisubstrate analysis for metals and toxic organic compounds. The two laboratories are interconnected through a computer communication network.

The regional laboratory provided testing on 1779 water samples for a total of 50,000 tests during 1983-84.

## HYDROMETRIC MONITORING PROGRAMS

### General

The collection and management of water quantity and sediment data in Western and Northern Region is the responsibility of the four Water Resources Branch Offices located in each of the three prairie provinces and the Northwest Territories. Memoranda of Agreement for Water Quantity Surveys, have been in place in the three prairie provinces and the Northwest Territories since April 01, 1975.

The Agreements require the establishment of federal-provincial Coordinating Committees to plan and review network operation, identify the operating agency, classify stations to determine responsibility for payment, and prepare annual reports. The table following indicates by province and territory, the number and designation of hydrometric stations operated under the agreements as of April 01, 1983. The Manitoba office operates 68 gauging stations for Ontario.

#### Number of Hydrometric Stations and Designation by Province as of April 01, 1983:

	<u>Fed</u>	<u>Fed-Prov</u>	<u>Prov</u>	<u>TOTAL</u>
Man.	97	110	87	294
Sask.	138	127	113	378
Alta.	133	207	146	486
NWT	65	34	33	132
NW Ont.	68	0	0	68
<b>TOTAL</b>	<b>501</b>	<b>478</b>	<b>379</b>	<b>1358</b>

The following Table summarizes the direct costs of operations under the hydrometric agreements for 1983-84. This table also illustrates the cooperative cost sharing nature of the hydrometric data collection program.

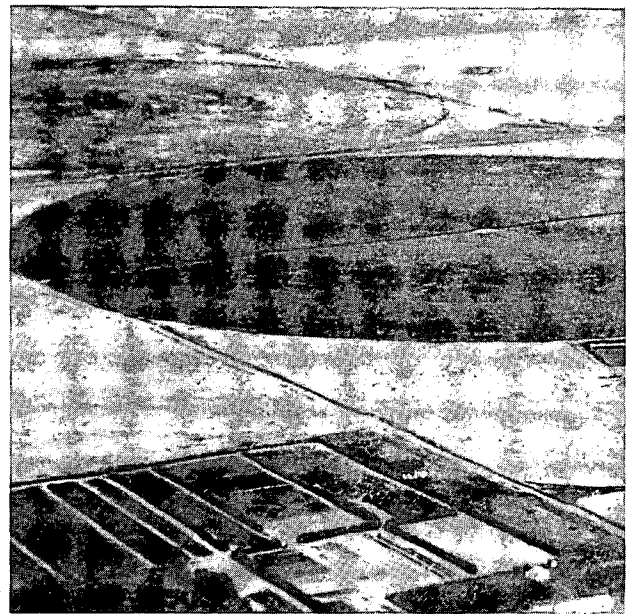
#### Total Hydrometric Program Costs and Shareable Costs for 1983-84 (\$'000):

	<u>Total Program</u>	<u>Shareable</u>	<u>Federal</u>	<u>Provincial</u>
Man.	1749	1134	690	444
Sask.	1946	1139	732	407
Alta.	2772	1711	859	852
NWT	2048	1527	939	589
NW Ont.	215	216	216	0
<b>TOTAL</b>	<b>8730</b>	<b>5727</b>	<b>3436</b>	<b>2292</b>

Total construction expenditures during 1983-84 are shown for the region in the Table below. Annual construction, upgrading and maintenance reports provide complete details on the construction program.

#### Summary of 1983-84 Construction Costs (\$'000):

Manitoba	147,387
Saskatchewan	150,019
Alberta	280,920
Northwest Territories	296,618
N.W. Ontario	32,050
<b>TOTAL</b>	<b>601,943</b>



### Saskatchewan

#### Summary of Hydrologic Events

After above normal temperatures and completion of spring runoff in April 1983, southern Saskatchewan experienced record low temperatures and two snow storms during May. The first deposited 15 to 25 cm of snow in the Cypress Hills/Saskatoon area while the second produced 25 to 50 cm in the southeast area of the province. This latter storm was the worst recorded May storm in Saskatchewan this century. June was sunny and warm but very heavy isolated showers resulted in localized flooding in southern areas. A series of heavy thunderstorms in July maintained unseasonably high flows in the Qu'Appelle, Wascana and Assiniboine basins. Damage estimated at 10 million dollars was reported in Regina due to one of these storms and the village of Pennant, northwest of Swift Current, received damage from a tornado. Precipitation throughout the rest of the fiscal year was generally below normal and resulted in below normal winter accumulations in spite of an early November snowfall. The variations in temperature were extreme with August being one of the hottest months on record and with December being one of the coldest.

The generally mild weather in the January to March 1984 period and the light winter snowpack resulted in the snow cover disappearing with very little runoff being generated.



## Federal-Provincial Memorandum of Agreement for Water Quantity

Hydrometric surveys undertaken within the 1983-84 fiscal year were of a routine nature. Emphasis was placed on the expansion and operation of satellite transmission facilities at various gauging sites. As of March 31, 1984 twelve data collection platforms are operational in the province. A five year plan to install an additional 36 units was prepared. Six installations scheduled for 1983-84 were delayed due to late equipment delivery.

The construction program consisted primarily of maintenance and upgrading activities. No new stations were constructed during 1983-84. Major and minor maintenance and upgrading projects were completed at 83 sites. The project undertaken to assess the stability of several rod and screw type benchmarks continued. After a year's testing, the use of a screw type rod anchor, similar to those used for guy wire anchors by utility corporations, appears to be an improvement over the rod type.

The safety inspection program for the 61 cableways in the Saskatchewan district was completed. Six cableways were rebuilt using steel A-frames. Electrical service was installed at three sites during the year enhancing hydrometric data collection. The total number of sites with electrical service increased to 165.

### Information Services

Further automation of the hydrometric data processing procedures took place during 1983-84. Interactive computation procedures were fully implemented in the district office utilizing SaskComp as a host computer or mainframe. A Gradicon Hi State Digitizer was installed and interfaced with the mainframe computer. Punched cards were eliminated as part of the hydrometric data computation process. In the latter part of the fiscal year, preparations were made for the installation of an in-house mini-computer, a DEC PDP 11/44. Renovations were completed to prepare for installation of the system early in the next fiscal year.

Data for gauging stations operated by Saskatchewan Environment were reviewed and placed in the national data bank (HYDAT). These stations are part of the active hydrometric network and are published by the Water Resources Branch.

Data is also available in printed format or microfiche. During 1983-84, 328 requests for data were addressed. Major clients obtain data directly from a data tape at the computer centre without contacting the Water Resources Branch.

### Special Projects

A bucket survey action plan for Saskatchewan was implemented. The plan has been accepted by and involves Atmospheric Environment Service,

Water Resources Branch, Agriculture Canada (PFRA), and the Saskatchewan Department of the Environment. In response to significant precipitation events, a bucket survey crew was dispatched to the area to obtain additional information on amount and distribution of precipitation. A survey was conducted on the portion of the June 24, 1983 storm which affected the Strasbourg area, 70 km north of Regina. This initial survey provided valuable experience needed for fine tuning the action plan. As a result, a review of the bucket survey criteria is underway.

Snow surveys have been conducted by the Water Resources Branch since 1962 in the Carrot River, Eagle (Eaglehill) Creek and Spruce River basins of Saskatchewan. A review of the need for the information was carried out and after discussions with clients, the surveys were discontinued.

## Manitoba-Northwestern Ontario

### Summary of Hydrologic Events

Medium flows were experienced during the 1983 spring break-up in southern Manitoba. The prolonged nature of break-up created a number of local ice jams which necessitated the use of both the Red River Floodway and Portage Diversion. Heavy snowpack and a quick melt resulted in ice jams on the Swan and Woody Rivers of west central Manitoba. This caused some agricultural flooding in the basins. Lake of the Woods basin experienced below normal run-off causing lake outflows to be reduced until mid-July.

Record high spring break-up flows were experienced in the Limestone, Weir, Kettle, Angling, Deer and Hayes basins of northeastern Manitoba.

Summer temperatures were above normal with below normal precipitation recorded.

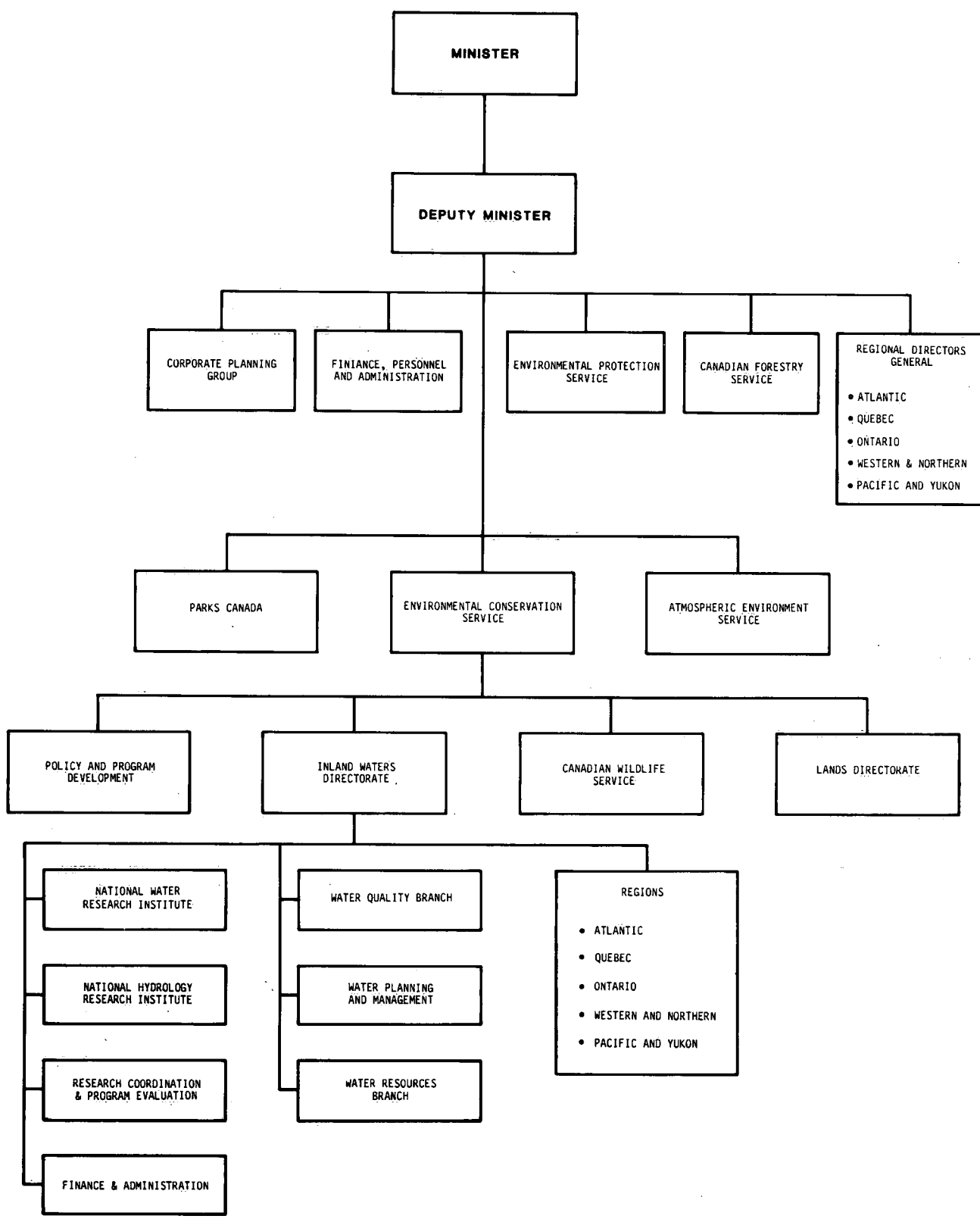
Fall and winter temperatures in southern Manitoba were normal with well below normal precipitation being received. Some areas of southern Manitoba were completely free of snow cover on March 1st. Break-up occurred in most areas of southern Manitoba in mid-March 1984 and was classified as a low flow event. High flows from the U.S. portion of the Red River basin resulted in a medium spring peak on the Red River at Emerson and Winnipeg. Flows in the Souris River at Coulter were below the authorized limit 0.57 cfs for one week in mid-October due to dewatering of the structure for inspection of the control structure on the United States' side.

In northern Manitoba a fall rain produced significant peaks in the Seal River basin in mid-September. Precipitation through the winter was above normal.

The annual snow survey in the Lake of the Woods basin indicated that the accumulated snowfall for the winter of 1983/84 was at or slightly below normal.

# Organization Chart

## Department of the Environment



concern to public groups. Canada contributed to the resolution of concerns expressed by these groups and in meeting its obligations for flow apportionment and water quality monitoring. A special mercury survey was conducted which revealed that the restriction placed on the consumption of fish from Cookson Reservoir could be lifted.

Policy advice on international issues was provided to DOE corporate groups responsible for assisting External Affairs in devising a Canadian position on water-related boundary issues. In 1983-84 issues of concern were the Garrison Diversion, raising of Lake Darling water levels, Red River flood protection, flood protection along the Pembina-Aux Marais Rivers, and storage on the Milk River. In all of these issues IWD has been instrumental in the determination of a Canadian position. Negotiations between Canada and the United States on the Garrison project have reached a critical stage. A technical committee and four task forces have been formed with active regional participation in all activities.

Regional staff members also contribute to the work of international bodies such as the World Meteorological Organization and the International Organization for Standardization.

#### INTERPROVINCIAL ACTIVITIES

##### Qu'Appelle River Basin Implementation Agreement

The ten-year agreement entered into under the General Development Agreement administered by the Department of Regional Economic Expansion expired on March 31, 1984. Agreement expenditures were planned to total \$33.7 million, but actual expenditures amounted to \$25.7 million, of which \$1.372 million was from Canada Water Act funds. Projects essentially completed include flood control works for Regina, Lumsden, Tantallon, Moose Jaw and rural portions along the Qu'Appelle River, the Regina tertiary sewage treatment plant, the Land Use Planning and Development controls program and some livestock pollution control works. A consultant's evaluation of the accomplishments under the agreement identified shortcomings in the Qu'Appelle River conveyance program and the livestock pollution control program. Completion of the Qu'Appelle River conveyance program is included under a proposed \$4.75 million agreement currently under negotiation with Saskatchewan.

A study of nutrient loading was completed and results were compiled revealing that phosphorus loadings to the lakes appear to have declined. Internal phosphorus loadings from sediments remains a major question in Fishing Lakes water quality.

##### Canada-Saskatchewan Consultative Committee

The Committee met on June 3, 1983 to discuss water-related matters of interest to the federal and Saskatchewan governments. The Committee agreed to meet at least once a year.

##### Canada-Saskatchewan Interim Subsidiary Agreement on Water Development for Regional Economic Expansion and Drought Proofing (SAW)

The Agreement which expired on March 31, 1984, provided for DOE, Department of Regional Economic Expansion (DREE) and provincial government funding for development of a water management strategy for economic development. A number of measures are included in the Agreement, dealing with drought proofing studies, water management investigations, community water supply projects and flood damage reduction measures for the Souris River Basin. Virtually no federal funds were spent under the Flood Damage Reduction Sector of the agreement because identified flood hazard areas were not designated, nor were appropriate zoning or land use regulations implemented as required. Joint federal-provincial designations have been curtailed by Saskatchewan pending the outcome of a provincial review of the Flood Damage Reduction Program.

Drought sensitivity studies were completed in 1983-84 to estimate the sensitivity of the Saskatchewan economy to drought. Other federal and federal/provincial water management activities and work on authorized water supply projects are continuing under Agriculture Canada (formerly DREE) and provincial funding. IWD is represented on the management group and the technical and advisory committees.

##### Canada-Manitoba Interim Subsidiary Agreement on Water Development for Regional Economic Expansion and Drought Proofing (MAW)

This agreement expires on March 31, 1985 and is similar in scope to the SAW agreement, but it contains no provisions for flood damage reduction works as these are contained in the Ring Dyke Upgrading Agreement. DREE and provincial funding are committed towards drought proofing studies, water management investigations and water supply projects. IWD is represented on the management group and the drought studies advisory group.

##### Canada-Manitoba Agreement on the Study and Monitoring of Mercury in the Churchill River Diversion

On March 10th, 1983, the Canada-Manitoba Agreement on the Study and Monitoring of Mercury in the Churchill River diversion was signed. The Agreement of the two governments resulted from concerns that began as early as 1977 when the first commercial fishing began in the Rat-Burntwood System after the diversion began operating. Mercury levels in fish were found to be as high as 2.0 ppm - well above the 0.5 parts per million (ppm) tolerance level for fish consumption in Canada and the 1.0 ppm in the United States of America. Also, by 1981, claim #12 under the Northern Flood Agreement resulted in an interim order by the arbitrator of the agreement obliging Canada and Manitoba to implement appropriate studies of mercury contamination resulting from the diversion. Work under the Mercury Agreement has progressed well to date with nine of the possible 14

## Federal-Provincial Memorandum of Agreement for Water Quantity

Under the agreement with Manitoba a total of 216 discharge, 78 water level and 18 sediment stations were operated by WRB for the Manitoba Water Resources Branch of the Department of Natural Resources. The Coordinating Committee met three times during the year. There were major changes in the network from the previous year with 28 hydrometric or sediment monitoring stations being discontinued and 9 additions. These changes were caused by budget reductions, a provincial review of their requirements for sediment data and a request from Transport Canada for hydrometric stations. There were 53 construction projects consisting mainly of maintenance and repair work and upgrading by the provision of electrical power. In addition to the construction work, 2 satellite data collection platforms (DCP) and 7 servomanometers were installed and 4 stations were reactivated.

In northwestern Ontario 39 discharge stations and 29 water level stations were operated by the Manitoba-Northwestern Ontario District, under the Canada-Ontario MOA which is administered by the WRB Ontario regional office located in Guelph. The hydrometric network increased by only one station and two new stations were constructed. The bulk of the hydrometric work is undertaken for the International Lake of the Woods Control Board, the International Rainy Lake Board of Control, and, in the Experimental Lakes Area, for Fisheries and Oceans Canada. Construction activity occurred at 8 other stations, mainly repairs and the installation of insulation. Telemarks were installed at two stations.

### Information Services

During 1983-84, approximately 1100 data requests were received and answered. Requests for current information represented approximately 79% of the total. Historical data and special types accounted for 11% and 10% respectively. Provincial agencies accounted for 33% of the data requests followed by federal agencies with 20% and private users with 12%. Engineering consultants, hydro companies and others made up the rest.

Prompted by the increasing number of requests for water level data a program was begun to place all water level data collected at discharge stations on a computer file for easy access and retrieval. Also during 1983/84 all historical discharge measurements were placed into a computer file.

The facilities and hardware for an in-house multi-user minicomputer based data processing system were in place by year end. The 1983 data was the last data produced using punched cards.

Public information activities, as distinct from the provision of hydrometric data, included the supply of general interest pamphlets and field demonstrations of stream gauging to

community college classes. Several hundred people stopped at the shopping mall exhibit during Environment Week. As well as learning of the activities and purpose of the Branch, they observed a current meter used to measure streamflow.

### Special Projects

A project to develop an accurate rating for the Lake St. Joseph Diversion at Root Portage, Ontario, was concluded in 1983, with the production of a report, "A Summary of the Discharge Computation Procedures" and Ontario Hydro's acceptance of the rating presented. The measurement of flow in this diversion is critical to the administration of the Manitoba - Ontario, Lake St. Joseph Diversion Agreement Authorization Act of 1958.

The state of the real-time reporting network was analysed and documented in "A Report on Telemetry and Provisional Data Services in the Manitoba-Northwestern Ontario District". At the 58 telemetry sites the direct resource requirements for the real-time, and near-real-time data services totalled 294 person-days and \$15,000.00 annually. Several recommendations for improving service and reducing costs were made and a number were acted upon during the year.

A runoff computer model known as SLURP was modified, calibrated and tested to the Boyne River in support of the Boyne River Pilot Study under the Flood Damage Reduction Program. The model was the simplest of the three tested in the study, and although flawed, it showed promise.

A Saskatchewan River monitoring study concluded that the site for the Saskatchewan River near Manitoba Boundary station was hydro-metrically unsuited for water quantity monitoring and the transboundary flows could be adequately computed using the record from Saskatchewan River at The Pas and Carrot River near Turnberry. The Prairie Provinces Water Board concurred and the station near the boundary was discontinued.

A five year DCP program was begun with the installation of two satellite data collection platforms. Preparations were begun for the installation of approximately one dozen DCPs a year over the course of the program.

### Alberta

#### Summary of Hydrologic Events

As was the case in 1982, flow conditions in Alberta varied considerably from area to area. Much of Alberta experienced below normal flow volumes. For example, Beaver River at Cold Lake Reserve recorded the lowest volume of annual runoff for the 29 year period of record (1982 had been the previous low). The volume of flow in 1983 was 27% of the 29 year average. This continues the trend of the past four years of much below normal runoff in this central east area of Alberta.

Similarly, in southwestern Alberta the annual volume recorded at the "Oldman River at Brocket" gauging station was 60% of the average for the past 17 years and was the second lowest for the period of record. Because of the shortage of water, a fall irrigation could not be carried out in the Lethbridge Northern Irrigation District.

Conversely, the Swan Hills area in central Alberta was subjected to six rain storms during June and July. Two of these storms produced peak flows very close to, or even slightly exceeding, the peaks for the period of record (approximately 20 to 25 years of record).

#### Federal-Provincial Memorandum of Agreement for Water Quantity Surveys

During 1983-84 two Coordinating Committee meetings were held, one which included participation by Administrators of the agreement. Significant items dealt with at these meetings included: the change from a 5-year to a 9-year expansion program (25 new stations per year rather than 50); reclassification of stations because of change in definitions and due to agency requirements; sediment studies; Electronic Data Processing (EDP) and Data Collection Platforms (DCP) equipment cost-sharing; budgetary items including the payment of a \$42K 1982-83 deficit by Alberta Environment; inventory of equipment and the proposed cooperative hydrology study.

The construction program included the installation of 20 new hydrometric stations. Maintenance was carried out at 28 sites and major construction conducted at 9 sites. In addition, two artificial controls were installed at stations operated by Alberta Environment.

The mini-computer system arrived and was installed in November 1983 - which was too late to utilize for 1983 data computations; however, on-the-job training has been, and is being, provided to the hydrometric staff such that all 1984 data will be computed utilizing this system. A Calcomp plotter was purchased, a program developed and paper printed for the production of hydrographs, which eliminated an onerous manual task.

#### Information Services

Data publication deadlines were met for both sediment and hydrometric data. In addition to major clients receiving the annual and historical publication and/or data tapes, 821 requests for data were fulfilled. Clientele included individuals, educational organizations, municipal agencies, industries, consultants and federal and provincial agencies. Approximately 40% of the requests were for interpretive and report data, while the remainder were for basic hydrometric information. Other data production and distribution included semi-monthly and annual apportionment reports on the St. Mary River; quarterly and annual apportionment reports on the South Saskatchewan River; daily flow messages on major streams to three provincial agencies and one federal agency (system

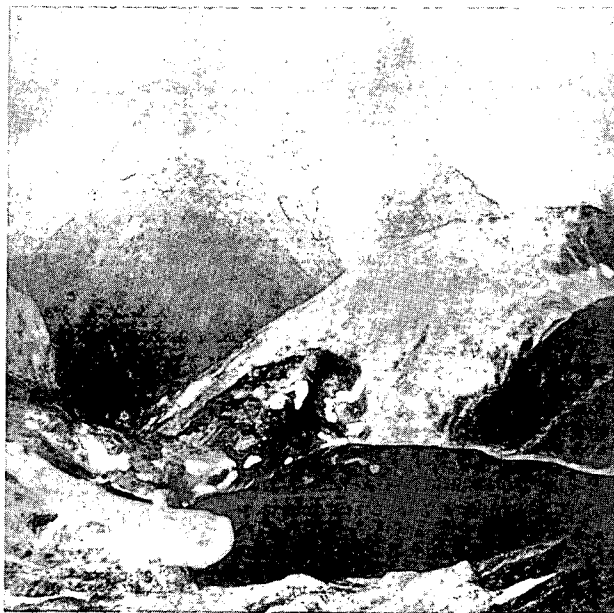
developed utilizing the minicomputer system and Datapac, eliminating the need for the telex and distribution on a monthly basis, of stream flow data for 54 hydrometric stations.

#### Special Projects

The major special project was the continuation of a cooperative study with the United States Geological Survey on determination of Milk River natural flow. Included in the study were monitoring of groundwater wells and piezometers, evapotranspiration instrumentation and documentation of water usages. A draft report, outlining a proposed natural flow computation procedure, was prepared.

Several studies were conducted for the Prairie Provinces Water Board including preparation of a first draft report on irrigation return flow for determination of natural flow of the South Saskatchewan River; completion of the Eyehill Creek natural flow study; updating the South Saskatchewan River natural flow computer model; and preparation of a first draft report on hydrometric network requirements for small interprovincial streams.

A battery/solar panel study was conducted to determine the type of power supply which should be utilized at manometer, telemark and DCP installations. All stations requiring electrical power and not equipped with 110V power will be equipped with sealed wet cells and solar panels in May of 1984. Field and bench tests on the Fluid Data System's hydrologic fluid-gauge were conducted and a report for national distribution prepared. The main recommendation of the report was that further testing and possible development of this type of gauge is required before any further purchases are made.



## Northwest Territories

### Summary of Hydrologic Events

Streamflow during 1983-84 were in the normal to below normal range in the Mackenzie basin and normal to above normal in the central and eastern Arctic. No extreme events resulting in flood damage were reported. Mackenzie River flows were near normal throughout the open water season and commercial shipping experienced a generally successful year shortened somewhat by an early freezeup on the lower Mackenzie River. Annual peak flows on a number of larger basins in central and eastern areas were both later and higher than normal - the possible result of a delayed snowmelt and summer rainfall. Several rivers peaked in September, an unusual event at these latitudes.

### DOE/DIAND Memorandum of Understanding for Water Quantity Surveys

During 1983-84, one joint Administrators/Coordinating Committee meeting and one Coordinating Committee meeting was held. Significant items addressed at the joint meeting included: a review of the 1982-83 cost sharing report; approval of schedules A and D and the network construction and capital purchase plan for 1983-84; discussion of a second draft report on a hydrometric network expansion plan for the Northwest Territories; and the data collection platform and mini-computer programs as these may affect northern operations. The Coordinating Committee meeting focused on a review of 1983-84 operations and forecasting 1984-85 activities and funding requirements. The five year capital expansion program approved by Treasury Board expired in 1983-84 and efforts were directed to evaluating future requirements and initiating a new five year proposal. Proposed revisions to schedule A were confirmed and tentative figures for schedule D were developed for 1984-85.

The 1983-84 Northwest Territories construction program included the installation of eight new hydrometric stations, five temporary (one season only) stations, five major maintenance projects, the deployment of 12 metering boats and 16 data collection platforms (DCPs). A small storage building was constructed at Frobisher Bay and a major face-lifting completed at the Baker Lake warehouse.

Field survey activities were carried out according to work plans prepared for each of six operations areas. Surveys and construction activities in Keewatin were supported during July and August by seconding one Yellowknife staff member to Baker Lake. Due to high overhead costs, lack of locally based aircraft and housing that was not suitable for winter occupancy, the Baker Lake sub-office was closed in October and for the next several years will be staffed as a base for summer operations only. The Inuvik sub-office space was expanded and a major expansion and renovation project including a computer room facility was completed in the Yellowknife office.

In addition to the Northwest Territories hydrometric program, field staff operated six sediment stations, 15 climate stations for AES, 11 climate stations for DIAND and obtained water quality samples from 42 sites for DIAND and the IWD Water Quality Branch. During the navigation season, the Mackenzie River stage forecast was prepared and distributed daily to various clients by telex. The forecast was based on the receipt of real-time data from a number of gauging stations on the Mackenzie River and its major tributaries downstream of Great Slave Lake.

### Information Services

Surface water data computations for 1983 were completed on an upgraded system consisting of a new solid state digitizer and a micro-computer communicating with a headquarters computer system. Replies were prepared for 86 requests for surface water and related data. Many of these were of a non-routine nature related to the construction of oil production islands in the Mackenzie River at Norman Wells and the oil pipeline connecting Norman Wells with Zama, Alberta.

### Special Projects

With the completion of two stations for a total of 11, the Mackenzie River Delta hydrometric network was completed in 1983-84. These stations will produce stage and flow data for input to the development and calibration of a hydrodynamic model to quantify flow distribution under various conditions in the principal delta channels. A flow metering program in support of model development will commence in 1984-85. A better understanding of these hydrologic processes will, in turn, lead to a better understanding of the ecologic systems that support the renewable resources of the region.

In addition to routine field work, a new concept of field camps were conducted on a pilot project basis at three remote gauging stations in June 1983. The camps, operated concurrently, were manned by two experienced technicians for a period of up to two weeks. The purpose of the surveys was to observe and record breakup and runoff characteristics of sub-Arctic streams, test field equipment and instruments under remote field conditions and to define and extend stage-discharge curves. The primary objectives of the surveys were met in all respects and the surveys will be repeated at selected additional sites in future years.

Five short term stage recording stations were constructed and operated in 1983-84. The locations were Hay River, Fort Resolution and Fort Reliance on Great Slave Lake and Hornby Bay and Fort Franklin on Great Bear Lake. The gauges, along with four automatic climate stations recording wind direction, wind velocity and barometric pressure were operated at the request of and with the financial support of Energy, Mines and Resources. The purpose of the stage data was, by means of

water level transfer techniques, to check the accuracy of the geodetic vertical control network from Hay River to Yellowknife and assist in the extension of the network from Fort Norman on the Mackenzie River to Coppermine on the Arctic coast.



## RESEARCH

The regional detachment of the National Water Research Institute provides research support to the Western and Northern Region. Research activities are a blend of applied research directed to immediate problems, and activities directed to increasing the knowledge necessary to meet the long term objectives of the Department in prairie and northern Canada. Potential expansion of irrigated and dryland farming, poor surface water quality in limited quantities, and continued development of resource industries, have led to research programs on toxic substances, and nutrient dynamics in surface waters.

In 1983-84 research focussed on the Qu'Appelle River Lakes, the North Saskatchewan River, and reservoirs of northern Manitoba. The Qu'Appelle system is typical of hypertrophic prairie lakes with an added complication of toxic substances (principally mercury). A workshop on the subject of hypertrophic prairie lakes was held as part of NWRI strategic planning. Work in the Qu'Appelle completed or in progress addresses physical processes affecting nutrient cycling and retention, biogeochemical cycling of mercury, and development of a biological screening tool for determination of chemical stress in prairie lakes. Work in northern Manitoba reservoirs addresses the problem of managing mercury accumulation in newly-flooded reservoirs and

the effects of impoundment on water circulation and nutrient supply under ice. Research on the North Saskatchewan River focusses on point and diffuse sources of toxic substances and the evaluation of effective strategies for ambient monitoring of riverine systems.

Work for a variety of clients, and flow of advice and expertise both to agencies within the region and to central agencies in Ottawa contributed to the transfer of new technology. Research scientists from Winnipeg delivered nine formal lectures and seminars by invitation to government external groups throughout Canada.

## TOXIC CHEMICALS

In response to DOE concerns related to toxic chemicals IWD, through the National Water Research Institute (WNR) and WQB, conducts research into the physical, chemical and biological ecosystems, and conducts monitoring and studies examining the presence of toxic chemicals, their abundance and prevalence in the aquatic ecosystem, their geographic distribution and their effects.

During 1983-84, NWRI continued research into the biogeochemical cycling of mercury and of other heavy metals and the use of biological methods for determining stress in aquatic ecosystems. The research was conducted in the Qu'Appelle River Basin, Tobin Lake, North Saskatchewan River, South Indian Lake area of Northern Manitoba and the English-Wabigoon River system of Ontario.

The Water Quality Branch conducted monitoring of metals in water at about 70 locations and for organic compounds at about 30 locations. A mercury study of the Cookson Reservoir ecosystem, Polar River Basin, Saskatchewan, was carried out. The cyanics of mercury in the Red River were studied in cooperation with the Province of Manitoba. Three new toxic chemical studies were proposed for funding consideration by the Departmental Toxic Chemical Management Program.

## ENVIRONMENTAL ASSESSMENT

Technical support was given to the office of the Regional Director General in the departmental assessment of several major regional development proposals, including the Beaufort Sea Hydrocarbon Production Proposal, the Slave River Hydro Proposal and two large scale heavy oil upgrader facilities.

Evaluations of a wide variety of project proposals, ranging from uranium mines in northern Saskatchewan to maintenance dredging in the Lake Winnipeg-Red River system were also undertaken under the auspices of the DOE Regional Screening and Coordinating Committee.

In compliance with the intent of the federal Environmental Assessment and Review Procedure (EARP) the Directorate has developed a regional procedure for determining the environmental implications of its own fiscal programs.

IWD participated with the Department of Indian Affairs and Northern Development's two main environmental committees for the Northwest Territories; the Regional Environmental Review Committee and the NWT Water Board Technical Advisory Committee.

## 5.0 FUTURE DIRECTIONS

The Department of Environment was established with a broad mandate "to foster harmony between society and the environment for the economic, social and cultural benefit of present and future generations of Canadians". IWD contributes to the achievement of departmental goals and objectives through annual strategic planning exercises which focus on existing and emerging problems which must be addressed. Within Western and Northern Region, the major water resource management issues identified as requiring future management action are as follows:

### Interjurisdictional Issues

Work is required to resolve water resource problems and conflicts along the international Canada-United States boundary, in particular the Red River, Garrison Diversion, Pembina Dam, Lake Darling Flood Control, Poplar River thermal plant expansion, and Rafferty Reservoir. A framework for managing the interprovincial resources of the Mackenzie River Basin is required and increasing emphasis will need to be directed to northward flowing streams such as the Slave River as interprovincial conflicts intensify with future development.

### Water Planning in the North

Water resource management plans are required for the North which are responsive to the strategic departmental requirements outlined in "Environment Canada and the North". Concern has also been identified for federal interests as the downstream jurisdiction for northward flowing streams. The development of an agreement between the provinces, the territories and DIAND on the transboundary water resources of the Mackenzie River basin is an important aspect of water planning in the North. Water resources planning must also be integrated with land use planning activities being pursued by DIAND, the Government of the Northwest Territories and major native organizations.

### Supply-Demand Management

Long term forecasts are required for water supply and demand within the region. Comprehensive supply management should be encouraged in the Prairies, and a regional planning approach is needed to ensure that water resources are used most efficiently.

### Water Quality

Water quality objectives and comprehensive monitoring programs are required for water

resource management in interprovincial, territorial-provincial, international, and National Park waters, in order to maintain desired uses and protect the quality for future generations. This will require regional and national overviews of existing water quality.

### Ground Water

Groundwater will play a significant role in helping to meet the growing shortage of water on the prairies. A better information base, understanding of factors most likely to affect quality, resource plans, operational capability, legal-administrative and interjurisdictional arrangements are necessary to help meet this role.

### Interbasin Transfers

Studies are required to assess the biological, socio-economic, land-use, financial and political considerations of major or transboundary diversions within the region.

### Drought

Studies are required to identify drought sensitive areas and to develop long term supply and demand forecasts for specific high priority water short areas. Alternative approaches for mitigating the effects of drought are required with more emphasis on demand management and sustainable yield.

### Acid Rain

Additional research is required to determine the impact of acid rain on activities such as recreation and tourism, fisheries, forestry and agriculture. The buffering capacity of representative lakes and streams and the more sensitive aquatic ecosystems within the Region needs to be identified.

### Floods

Cooperation with the provinces and territories to reduce the impact of floods continues to be a problem. Flood plain use compatible with the flood hazard should continue to be promoted.

### Information Services

Additional effort is required to ensure that reports, brochures and data bases are prepared and made readily available to the general public and specific user groups, and to ensure the transfer of technical expertise from the public to private sectors.





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