

BEAVER RIVER
AT ALBERTA - SASKATCHEWAN BOUNDARY

PPWB REPORT 69

**NATURAL
FLOW**

MAY 1984

PPWB REPORT #69



PRAIRIE PROVINCES WATER BOARD

CANADA ALBERTA SASKATCHEWAN MANITOBA

TECHNICAL REPORT TO THE
PPWB COMMITTEE ON HYDROLOGY

NATURAL FLOW

BEAVER RIVER

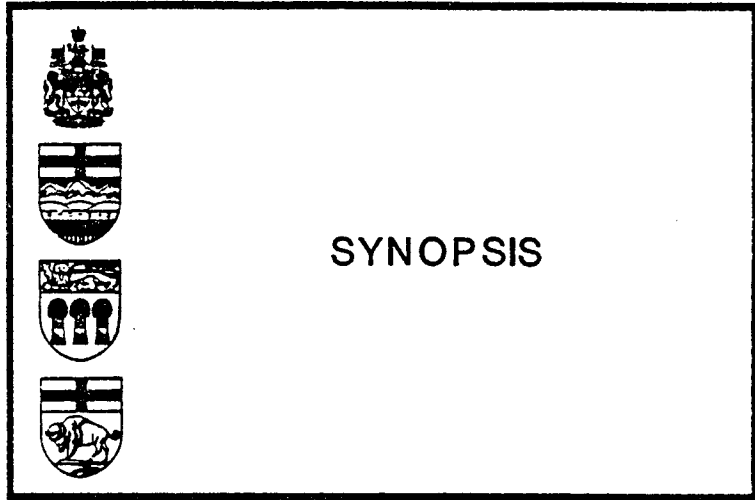
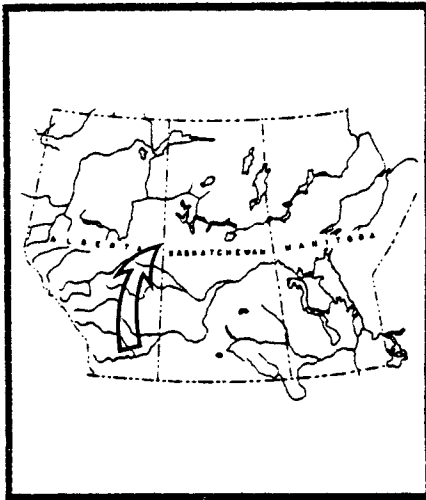
AT ALBERTA - SASKATCHEWAN BOUNDARY

MAY 1984

PPWB REPORT #69

PREPARED BY:

THE SECRETARIAT
PRAIRIE PROVINCES WATER BOARD



SYNOPSIS

The average annual natural flow of the Beaver River at the Alberta-Saskatchewan boundary is 647 000 dam³ (cubic decametres). Average annual water use in the Alberta portion of the basin in 1982 amounted to 4 426 dam³, less than one percent of the average annual flow.

The present level of consumptive use (1982 level of use) in the Alberta portion of the Beaver River basin would not have exceeded Alberta's 50% share of the natural flow in any of the 71 years (1912-1982).

It is recommended that monitoring of apportionment not be implemented at this time in the basin and that no new hydrometric stations be established for apportionment purposes. A methodology is also described that can be used to estimate natural flow at the boundary if monitoring of apportionment is needed.

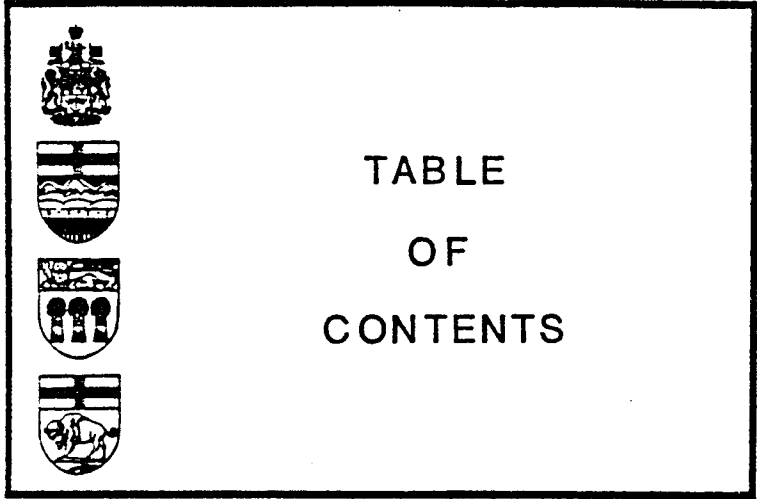
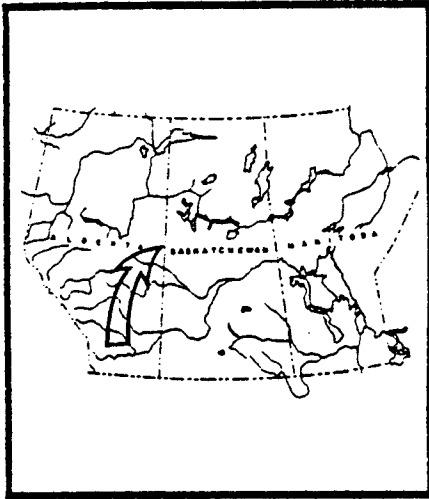


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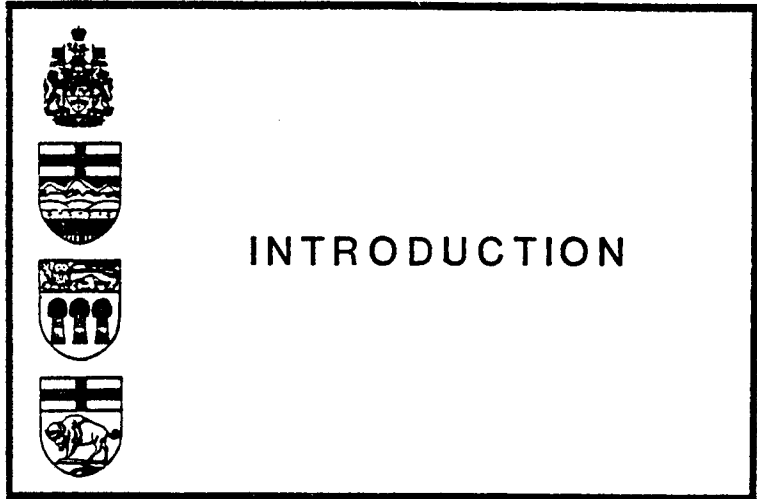
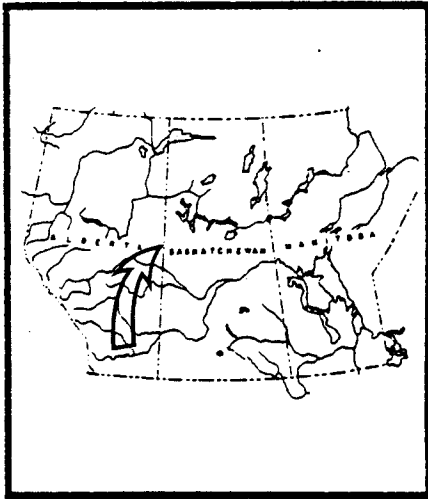
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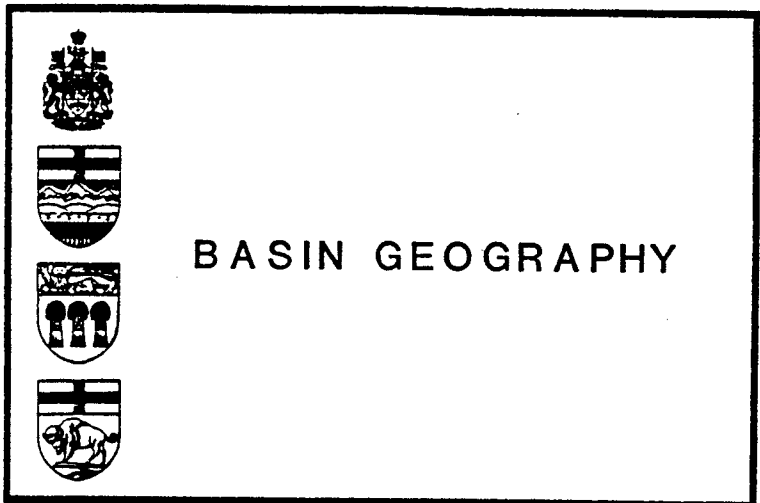
INTRODUCTION

The Beaver River Natural Flow Study is one of a series of natural flow studies being conducted for the Prairie Provinces Water Board (PPWB). Following the completion of the PPWB study on the determination of natural flow in the North Saskatchewan, South Saskatchewan, Saskatchewan, Churchill and Qu'Appelle River Basins in 1977, the Board agreed to study several smaller interprovincial river basins to determine if their apportionment balance needed to be monitored. A list of interprovincial basins was prepared and priorities assigned to that list of basins. The Beaver River was not initially included because it was considered to be part of the Churchill River Basin which had already been studied. At Meeting No. 25, the Board agreed that a separate study should be made of the Beaver River and passed the following motion:

"The Board instructed the Secretariat to undertake a natural flow study of the Beaver River at the Alberta-Saskatchewan boundary using the information originally prepared for the Churchill River Natural Flow Study Report and the information currently being gathered for the Beaver River Basin Study being conducted by Alberta Environment ...".

PPWB Minute 25-49

This report describes the basin geography, water uses within the basin, the derivation of natural flows and the preparation of estimated historic natural flows at the Alberta-Saskatchewan boundary. The present level of use in the basin is analysed in conjunction with these natural flows to indicate whether there is a potential for apportionment deficits at the present level of use.



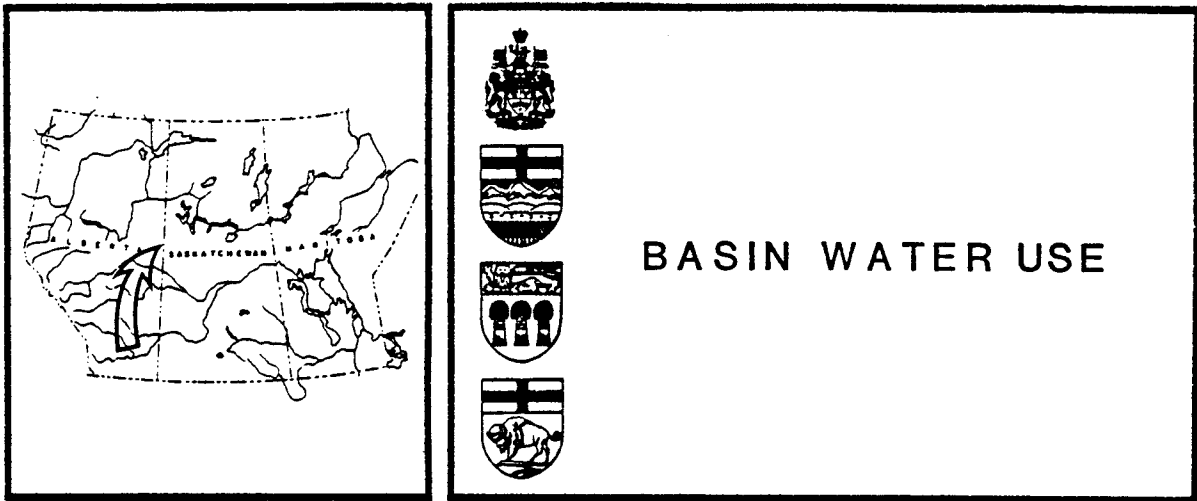
The Beaver River is an unregulated eastward flowing interprovincial stream tributary to the Churchill River, and is apportioned under the terms of the 1969 Master Agreement on Apportionment. The river rises in Alberta (see Figure 1) and flows some 660 kilometres to the east where it becomes part of the Churchill River at Lac Ile-a-la-Crosse. The northern and eastern portions of the basin are almost completely forested and contain several sub-areas of poorly drained bogs and muskeg. In contrast the southern portion of the basin, often referred to as the Beaver River Plains Region, is characterized by gently rolling land covered with glacial till deposits. This area supports most of the basin's agricultural activities.

Water quantity monitoring has been conducted since June 1955 at the "Beaver River at Cold Lake Reserve" hydrometric station (06AD006). This site, located 29.4 kilometres upstream from the Alberta-Saskatchewan Boundary measures most of the runoff from the Beaver River in Alberta. At this point, the river drains approximately 30% of the total Beaver River basin, and contributes about 30% of the average annual flow of the Beaver River as measured below its junction with the Waterhen River.

For the most part, the natural flow characteristics of the Beaver River in Alberta have not been affected by the activities of man. The undulating topography that is typical of the Alberta portion of the basin is well drained. This may be illustrated by comparing the river's effective drainage area of

11 600 km² to its gross drainage area of 14 500 km², a ratio of 0.8, at the Beaver River at Cold Lake Reserve Hydrometric Station. The effective and gross drainage areas tributary to several other points in the basin are listed on Figure 1.

Water quality measurements have been taken at the Alberta-Saskatchewan boundary on a monthly basis since April 1974. The data gathered indicates that the quality of water crossing the interprovincial boundary is satisfactory for most withdrawal and instream uses, but that nutrient and dissolved oxygen levels occasionally fail to meet the 1973 PPWB Water Quality Objectives. While no further mention of water quality is made in this report on natural flow it is realized that water quality must also be considered in any analysis of the effect that development might have on the basin.



No large industrial or municipal users take water from the Beaver River in Alberta. Present recorded water uses include domestic, agriculture use for stock-watering and water uses connected with several projects built by Ducks Unlimited. Information on minor projects in the application, authorization, and licenced stage was obtained from the Surface Water Rights Branch of Alberta Environment. The data provided was used to produce an itemized list of all current water uses in the Beaver River basin above the Alberta-Saskatchewan boundary as shown in Table A-1.

Instream water uses are also important on the Beaver River because the stream provides an excellent wildlife and aquatic life habitat. The Beaver River in Saskatchewan supports a valuable recreational fishery and its oxbows and low lying areas that are covered each spring provide good spawning habitat. The river's oxbows and delta also provide excellent habitat both for waterfowl and furbearers. Ducks Unlimited has been particularly active in developing projects in the Beaver River both upstream and downstream of the Alberta-Saskatchewan boundary.

Water uses located outside the effective drainage area have not been included in Table A-1 because they do not affect streamflow in an average year. Projects that had not proceeded beyond the application stage were also not included because it was assumed that they had not been completed. No attempt was

made to identify unauthorized projects or unreported changes to authorized projects. Based on field work previously done in connection with the Assiniboine River Basin Study (PPWB Report #57), it was assumed that the aggregate total of unauthorized projects would be insignificant for the purposes of estimating historic natural flows. If monitoring of apportionment is required on this basin, all authorized and licenced projects in Alberta should be inspected and the tributary basins should be checked for unauthorized uses of water.

There were three Ducks Unlimited projects in the upper portion of the basin and special attention was given to estimates of what the actual water use was in these three projects. These estimates were made by the Alberta Surface Water Rights Branch and, for the purposes of this study, these estimates were used rather than the licenced values. The three projects are listed separately in Table A-2. The revised estimates of annual use indicate a total use of 1 110 dam³.

Alberta Water Rights records also document eleven cancelled projects in the Beaver River basin. Only four of these projects reached the authorization stage. Two of the four projects were authorized and subsequently cancelled before streamflow records were taken on Beaver River at Cold Lake Reserve. They are listed in Table A-6(A) and have received no further consideration in this report because they do not affect the process of estimating natural flow from recorded data.

Two projects were operated in 1969 and 1970 and subsequently cancelled in 1979. They are listed in Table A-6(B) and their recorded use in 1969 and 1970 is listed in Table A-6(C).

The monthly total use figures for these projects have been added to the uses for currently active projects to give an estimate of total use during the historic period.

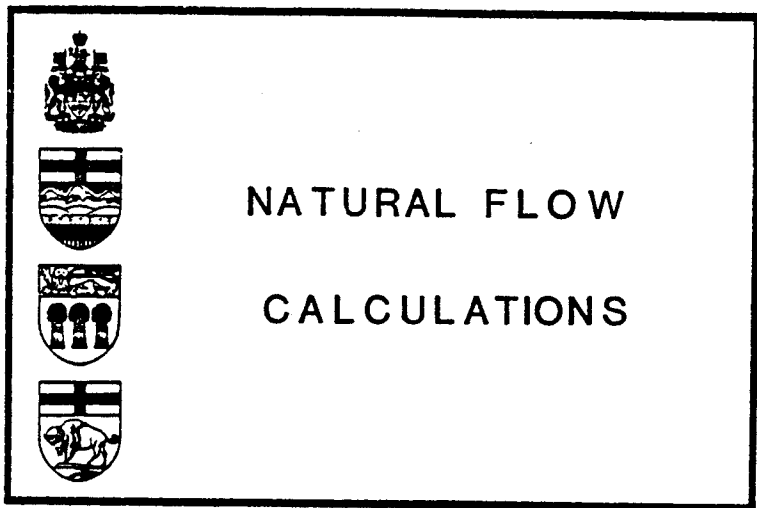
A similar process was used to tabulate water uses in the Saskatchewan portion of the basin between the Cold Lake Reserve and Dorintosh stations so that the hydrometric streamflow records at Dorintosh would also be based on natural

flow. The water uses shown in Table A-3 were provided by the Water Rights Branch of the Saskatchewan Department of Environment.

Some assumptions were made to determine the duration and variability of water use in both Alberta and Saskatchewan. It was assumed that a project would be operated from the year that it was authorized until the year it was cancelled (unless otherwise indicated). The uses were then arbitrarily apportioned between the months of April, May and June of each year, assuming that 30% of that use would occur in April, 40% in May, and 30% in June. These assumptions were based both on a visual inspection of streamflow figures for the period 1955 to date and on past experience in dealing with water use withdrawals on similar streams. The resulting tables of water use for the Alberta and Saskatchewan portions of the basin are shown in Tables A-4 and A-5.

At the 1982 level of development, the estimated total annual use of all projects now using water in the area tributary to Beaver River above the Alberta-Saskatchewan boundary is 4 426 dam³. There are no recorded instances of inter-basin transfers of water in the basin so the estimates shown in Tables A-4 and A-5 for 1982 may be used to estimate the present level of monthly and annual use in the Beaver River basin tributary to stations 06AD006 and 06AD001.

In 1980, Alberta Environment initiated the "Beaver River Basin Water Resources Management Study" to identify future water supply and water management alternatives in the Alberta portion of the basin. This study was completed in 1982. Preliminary investigations were also conducted to evaluate flooding problems and potential storage and diversion sites on the Beaver River. One site specifically suggested was the Truman Damsite upstream of the interprovincial boundary near the mouth of the Sand River. If a reservoir was built at this site, its subsequent operation might radically change the streamflow characteristics of the river at the interprovincial boundary.



Natural flows are calculated by adding water uses to recorded flows to produce an estimate of the volume of water that would have been measured if the river flows had not been altered by human interference or intervention. The approach used to calculate natural flows in this study is known as the project depletion method.

A monthly natural flow array covering the period from 1912 to 1982 inclusive was developed for the hydrometric gauging station, Beaver River at Cold Lake Reserve (06AD006). The starting date for this time period, 1912, was arbitrarily chosen to coincide with the 1912 starting year used in the 1972 Saskatchewan-Nelson Basin Study. It is anticipated that these estimates will become part of the PPWB data bank of monthly natural flow and the choice of a common starting date will make it easier to integrate this flow array with others in the same data bank.

The quality of the estimates from 1912 to 1932 and 1941 to 1955 is poor because no usable streamflow records were available in the immediate area. Anyone using these estimates for further evaluations of the Beaver River should do so with caution. It is also recommended that future users check the coefficients of correlation and standard errors of estimate shown in Table B-7 to gain a better appreciation of the limitations of the estimated data.

The natural flow array for Beaver River at the Alberta-Saskatchewan boundary was developed in two steps. The first step was to calculate natural flow based on the recorded period of flow from 1956 to date, and the second was to estimate the missing record prior to 1956.

Step 1: Estimate of Natural Flow - 1956 to 1982 inclusive

The uses for each year for the period 1912 to 1982 inclusive were itemized as described in the previous chapter on basin use. An examination of streamflow in the Beaver River (see Table B-1) indicated that most runoff occurred in the months of April, May and June with May usually recording the largest flow. Some large flows were also observed in July but these were assumed to be caused by summer storms and were not a consistent recurring event. Therefore, for any basin water use not otherwise documented, it was arbitrarily assumed that 30% of consumptive use occurred in April, 40% in May, and 30% in June. The basin uses shown in Tables A-4 and A-5 were then added to recorded flows to create estimated arrays of natural flow for the recorded period. Because of the relatively small size of the basin and the uncertainty of when such water uses occurred, no attempt was made to introduce a lag factor into the estimating process. The resulting monthly natural streamflow array is shown in Table B-3.

Step 2: Estimate of Natural Flow - 1912 to 1955 inclusive

The Beaver River is located in an area where there was only limited streamflow measurement activity prior to the 1950's. There were some measurements taken on the Beaver River near Dorintosh during the summer months from 1933 to 1940 and these, and more recent flows, were adjusted to a natural flow level using the same process as described for station 06AD006 (see Table B-4). A good relationship was obtained using a simple regression between the stations Beaver River near Dorintosh (06AD001) and Beaver River at Cold Lake Reserve (06AD006). The resulting equations were used to fill in missing summer records from 1933 to 1940 inclusive.

Several hydrometric stations were tested and rejected in an attempt to establish a significant regression equation to fill in the remaining period of

missing record. The rejected stations included; Battle River near Unwin, Athabasca River at Athabasca, and Churchill River at Sandy Bay (Island Falls). The best statistical relationship was obtained using a regression based on natural flows in the North Saskatchewan River (see Tables B-5 and B-6) and Beaver River streamflow for the previous month. This relationship used three variables:

1. Beaver River at Cold Lake Reserve (06AD006) lagged one month.
2. North Saskatchewan River at Edmonton (05DF001).
3. North Saskatchewan River at Prince Albert (05GG001).

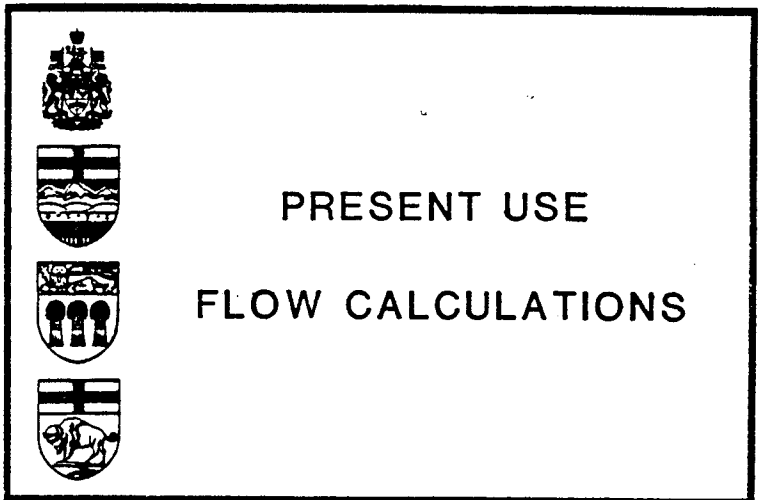
A starting point was needed to produce a monthly estimate at station 06AD006 (Variable No. 1) so the month of January, 1912 was estimated by using the average monthly natural flow for January for the recorded period of record.

The resulting streamflow estimates were tested by comparing their mean monthly values and estimated maximum and minimum monthly flow to similar values for recorded flows from 1956 to 1982. The estimates gave lower mean values and showed less variability between their maximum and minimum values than recorded flows, indicating that the estimates did not have the same characteristics as the original sample. An examination of the estimated data showed that the use of the first variable (Beaver River at Cold Lake Reserve - lagged one month) produced a continuing averaging effect on all flows. After testing several months it was determined that creation of a discontinuity in May of each year would eliminate the averaging tendency with only a small negative effect in the mathematical accuracy of the regression equations. Consequently the "averaging" factor was removed for the regression for the month of May. The resulting regressions gave results with characteristics that were similar to the original sample. They are shown in Table B-7.

The estimated monthly flows for Beaver River at Cold Lake Reserve were transposed to the Alberta-Saskatchewan boundary using a ratio of the effective drainage areas (1.034). The resulting streamflow array, shown in Table B-8, is

an estimate of natural flow of the Beaver River at the Alberta-Saskatchewan boundary from 1912-1982 inclusive.

Users of estimated flows for further studies should recognize the limitations of the estimated periods from 1912 to 1932 and 1941 to 1955. The coefficients of correlation and standard error of estimates for the regressions used to estimate the data suggest that the quality of the estimates is poor for the years when priority 2 is used to estimate the months of April to September (see Table B-7). The estimates have been published because it is unlikely that better estimates of streamflow at this site can be generated, based on the present level of hydrologic expertise in estimating missing streamflow data. These estimates, rough as they are, provide a means of testing the basin's response to long drought periods such as those that occurred during the period from 1912 to 1954.



The present level of use in the Beaver River Basin is small, less than 1% of the average annual natural flow. Furthermore, there are no large individual uses so adjustments to natural flow can be based on an estimate of the effect that presently licensed uses will have on streamflow. In the previous chapter it was arbitrarily assumed that uses would be distributed as follows; April 30%, May 40% and June 30%. The present level of use (4 426 dam³) may be distributed as:

April - 0.51 cubic metres/sec/month (1 328 dam³)
May - 0.66 cubic metres/sec/month (1 770 dam³)
June - 0.51 cubic metres/sec/month (1 328 dam³)

The above values for April, May and June are added to recorded monthly flow of the Beaver River at Cold Lake Reserve (06AD006) to provide estimated natural monthly flow.

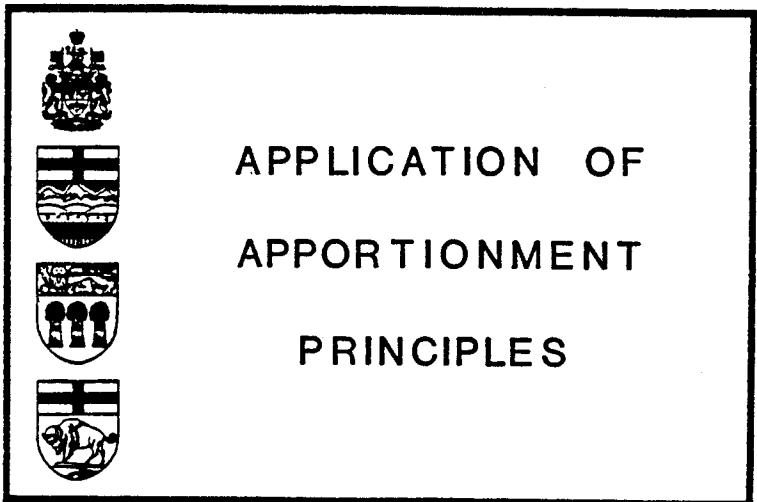
The method presently used to transfer natural flow estimates to the boundary site is to multiply natural flow at the gauging station by 1.034 based on the ratio of effective drainage areas at the two sites (see Table B-8).

This method may be improved in future years using new information being gathered by WSC (Water Suvery of Canada). A hydrometric station has been established on Reita Creek near the outlet of Angling Lake (06AD013). This station controls over half of the drainage area between the Beaver River hydrometric

station and the boundary and, based on one year of records appears to have a much smaller unit yield than does the Beaver River station. The local Beaver River runoff could be based on discharge records from this station when more data has been gathered to confirm its applicability as an index station.

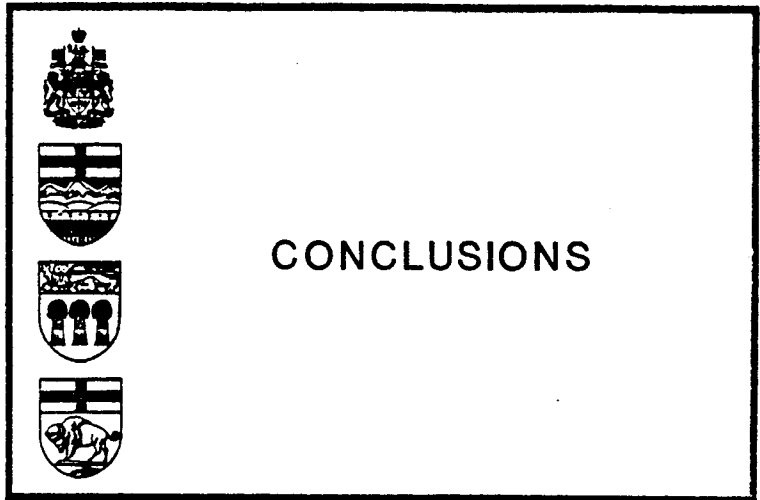
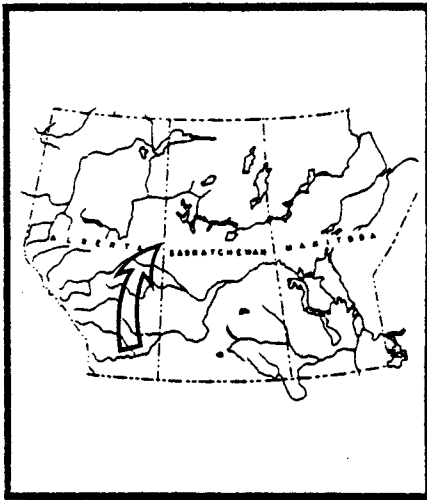
The method presently used should be rechecked if the stream is monitored for apportionment purposes and that check should include:

- 1 - A field examination to ensure that all authorized projects are being used.
- 2 - An office evaluation of the methods used to transfer flows from the hydrometric station 06AD006 to the Alberta-Saskatchewan Boundary with emphasis on the possible use of the Reita Creek hydrometric station to improve the accuracy of the estimates.



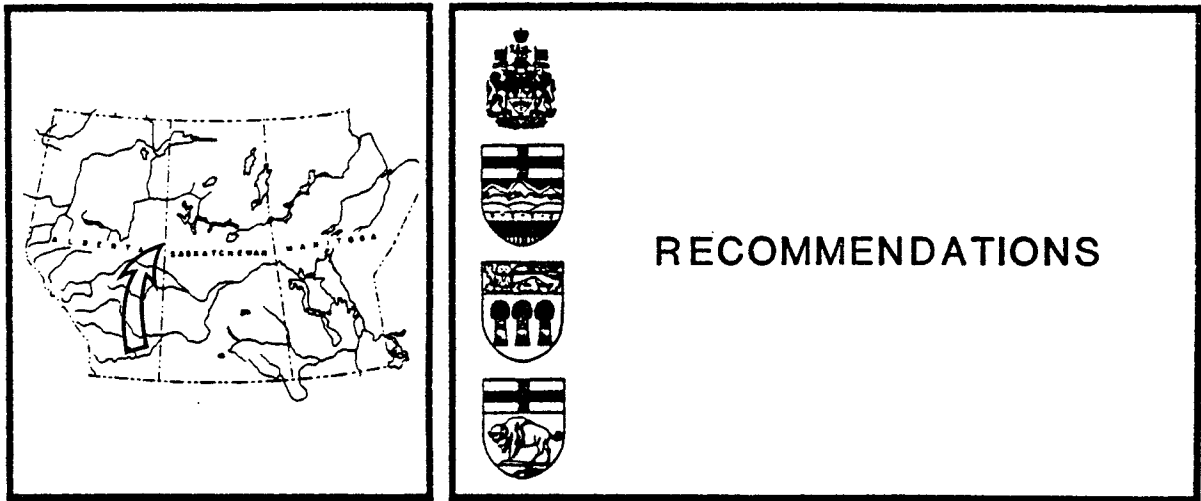
An analysis was made to determine whether Alberta, at its present level of use, would have exceeded its share of the natural annual flow of the Beaver River in any year during the period 1912 to 1982. A monthly array of uses was created assuming that minor uses were constant at the 1982 level of use. The resulting array of monthly uses was subtracted from the natural flow array at the interprovincial boundary giving an estimate of monthly flows that would have occurred at the interprovincial boundary during the period 1912 to 1982 if the 1982 (present) level of use had been in effect for the entire period.

An array of one-half of natural monthly flow at the interprovincial boundary was then subtracted from the array of monthly flows adjusted for present uses. The residual monthly flow array is shown in Table B-9. The array had no negative values indicating that, in all months and in all years of the period 1912 to 1982 inclusive, Alberta would have passed more than 50% of Beaver River flow to Saskatchewan at the 1982 level of development and would have fully met the requirements of the 1969 Apportionment Agreement.



The average annual water use in the Alberta portion of the Beaver River basin of the present (1982) level of development is 4 426 dam³, 1.4% of Alberta's 50% share of the average annual natural flow of the Beaver River at the Alberta-Saskatchewan boundary. The driest year in the estimated period of 1912 to 1982 inclusive was 1938 when 154 300 dam³ was estimated. At the 1982 level of development, Alberta would have used less than 6% of their 50% share of this flow. Based on the present level of use, Alberta would have passed more than 50% of natural flow at the interprovincial boundary in all years of the period 1912 to 1982 inclusive.

The monthly hydrometric records for Beaver River at Cold Lake Reserve (station 06AD006) adequately represent the interprovincial flow of the Beaver River at the Alberta-Saskatchewan boundary. At the present time, there is no necessity to establish additional hydrometric stations upstream from the boundary to measure flow for apportionment purposes. If major diversions in or out of the basin are contemplated in the future, the amount of diverted water should be recorded on a continuing basis.



The three recommendations arising from this report are:

1. Concerning the Implementation of Apportionment

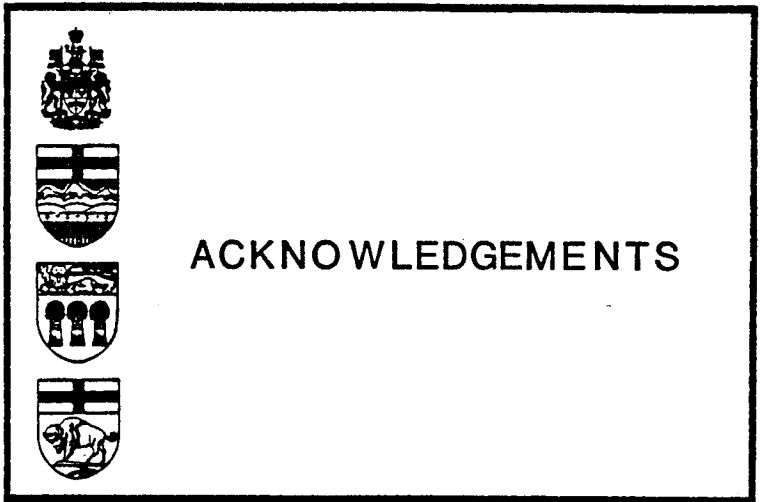
It is recommended that, based on the present level of use in the Beaver River basin in Alberta, monitoring of apportionment not be implemented at the present time.

2. Concerning the Network of Hydrometric Stations

It is recommended that no new hydrometric stations be established for apportionment purposes but it is recognized that, if new major diversions are constructed, the resulting differences in flow should be measured.

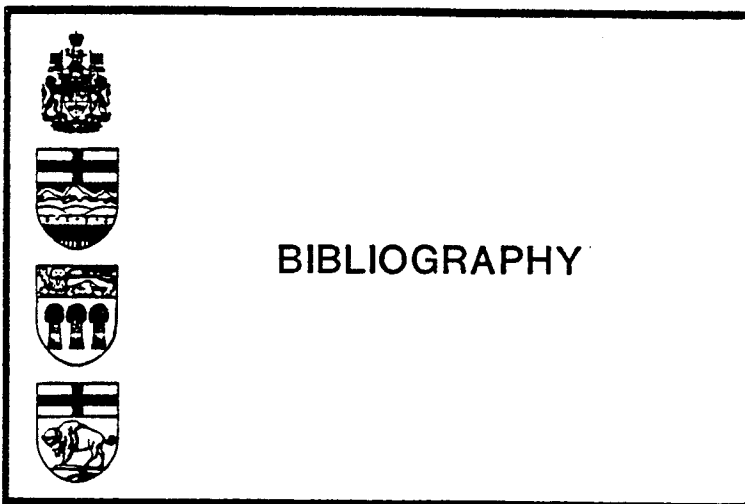
3. Concerning the Method to be Used to Calculate Natural Flow

It is recommended that, when needed, natural flow at the Alberta-Saskatchewan boundary be calculated using the methodology described on pages 14 and 15.

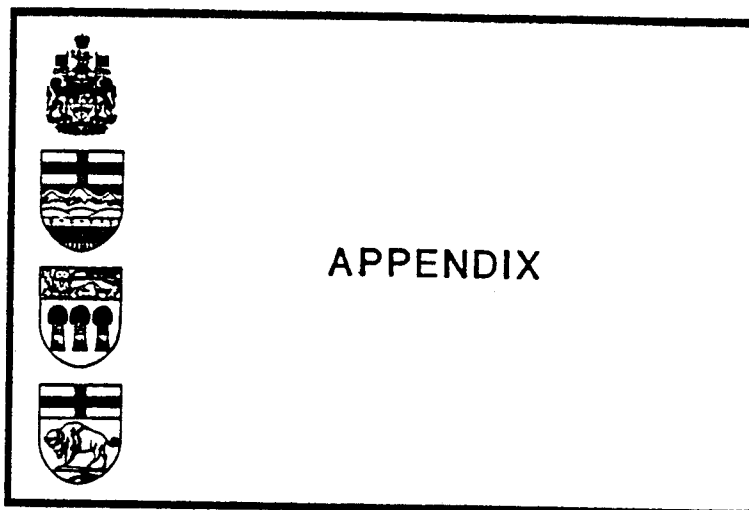
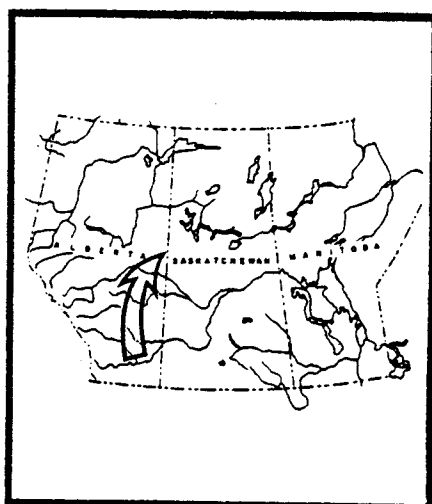


ACKNOWLEDGEMENTS

The Beaver River Natural Flow Report was prepared by R.B. Godwin, Executive Director of the Prairie Provinces Water Board, and A.J. Chen, Operations Engineer of the Prairie Provinces Water Board. A note of thanks must be given to the assistance provided by A.J. Ferrett of Alberta Environment and T.K. Olson of Saskatchewan Environment in producing estimates of present uses, and to G. Mason and P. Turnham who typed the numerous drafts and the final report.



1. May 1983, The Determination of Gross and Effective Drainage Areas in the Prairie Provinces, Agriculture Canada, Prairie Farm Rehabilitation Administration, Hydrology Division Report No. 104.
2. Bothe, R.A. - October 1980 - Beaver River Water Balance, Alberta Environment, Hydrology Branch, Hydrology Report H10.6A (limited distribution report).
3. December 1978, Antler River at Saskatchewan-Manitoba Boundary - Natural Flow, Canada Department of Regional Economic Expansion, Prairie Farm Rehabilitation Administration - PPWB Report No. 52.
4. Natural Flow - South Saskatchewan River Basin - Main Report and User Manual Water Survey of Canada, Calgary, Environment Canada - PPWB Report No. 45.



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Table B-9 - One-Half of Natural Monthly Flow Extended, Minus Alberta Water Uses at Their Present Level of Development (This array demonstrates how much water Alberta would have available for future development after passing 50% of natural flow to Saskatchewan).	43

FIGURES

Figure 1 - Location Map of the Beaver River Basin	45
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TABLE A-1

WATER USES IN THE BEAVER RIVER BASIN IN ALBERTA

File	Location	Period of Operation	Use (dam ³)	Type of Use
✓ 796	SE13-66-15-W4	1915-	90	Industrial
801	NE17-65-17-W4	1916-	123	Other
1833	SE01-65-03-W4	1928-	123	Other
2133	SE20-61-06-W4	1931-	125	Industrial
3732	NE13-66-14-W4	1937-	12	Other
14071	NE27-62-13-W4	1953-	740*	Other
1639	SW03-63-02-W4	1958-	0	Diversion
12725	SE24-63-07-W4	1962-	0	Diversion
13003	SE19-61-06-W4	1963-	0	Diversion
13004	SE16-61-07-W4	1964-	0	Diversion
11861	NE15-64-03-W4	1965-	432	Industrial
✓ 847	SW22-63-05-W4	1966-	0	Diversion
✓ 847	NE06-63-05-W4	1966-	0	Diversion
8735	SW15-61-06-W4	1966-	617	Municipal
✓ 12210	NW11-61-06-W4	1967-	41	Irrigation
✓ 12714	NE02-61-08-W4	1967-	0	Diversion
12367	NW12-65-19-W4	1968-	111	Municipal
✓ 12381	SW32-60-02-W4	1968	43	Irrigation
✓ 12382	SE04-60-07-W4	1968-	62	Irrigation
✓ 12463	NE09-62-03-W4	1968-	0	Diversion
✓ 12582	SW12-63-04-W4	1969-70	45.6	Industrial
✓ 12596	NW24-60-07-W4	1969-	2	Domestic
✓ 12770	SE16-62-02-W4	1969-70	87.2	Industrial
✓ 12781	SW09-64-11-W4	1969-	4	Domestic
✓ 19664	SW26-62-05-W4	1969-	0	Diversion
✓ 12958	NE07-64-13-W4	1970-	2	Domestic
✓ 14084	SW33-61-12-W4	1970-	247*	Other
✓ 14086	NE08-61-11-W4	1970-	123*	Other
✓ 13945	NW34-64-17-W4	1972-	37	Irrigation
✓ 15190	SW06-59-06-W4	1973-	49	Municipal
✓ 16998	SW19-62-05-W4	1975-	0	Diversion
✓ 17066	SW11-61-09-W4	1975-	0	Diversion
✓ 13404	SE13-63-03-W4	1976-	0	Storage Only
✓ 17375	SW29-63-05-W4	1976-	0	Diversion
17790	NW11-61-06-W4	1976-	0	Diversion
✓ 17667	SE36-61-02-W4	1977-	173	Industrial
✓ 847	SW05-63-05-W4	1978-	0	Diversion
✓ 15356	NE15-64-03-W4	1978-	1 110	Industrial
19933	24-63-11-W4	1978-	0	Storage Only
✓ 19082	NW13-63-02-W4	1979-	0	Diversion
✓ 19265	SW07-64-03-W4	1979-	0	Storage Only
✓ 1639	NE33-62-02-W4	1980-	0	Diversion
✓ 19314	SE12-63-03-W4	1980-	0	Diversion
✓ 19512	NW12-64-03-W4	1980-	0	Storage Only
✓ 19592	NW15-61-10-W4	1980-	0	Diversion
✓ 8735	SW15-61-06-W4	1981-	160	Municipal

* Revised estimates of use were prepared by Alberta for this study
(see Table A-2)

TABLE A-2

DUCKS UNLIMITED PROJECTS IN THE ALBERTA PORTION
OF THE BEAVER RIVER BASIN

File Number	Land Location	Period of Operation	Reservoir Name	Estimated Annual Use (dam ³)
14071	NE 27-62-13-W4	1953-date	Whitefish Lake	740
14084	SW 33-61-12-W4	1970-date	Bunder Lake	247
14086	NE 8 -61-11-W4	1970-date	Norberg Lake	123

Annual Use estimated in 1981 by Surface Water Rights Branch of Alberta Environment
All three projects are authorized (but not licensed) for "Other" purposes.

TABLE A-3

WATER USES IN THE BEAVER RIVER BASIN BETWEEN THE ALBERTA-SASKATCHEWAN
BOUNDARY AND THE HYDROMETRIC GAUGING STATION NEAR DORINTOSH,
SASKATCHEWAN.

File	Location	Period of Operation	Use in dam ³	Type of Use
53215	NW-13-60-26-W3	1937-50	0	DOMESTIC
55055	SW-32-58-24-W3	1948-57	216	OTHER
11854	SW-28-62-26-W3	1972-to date	16	OTHER
10162	NE-28-62-26-W3	1973-to date	379	OTHER
12233	SE-27-58-26-W3	1973-to date	222	OTHER
10485	NW-19-57-25-W3	1974-to date	1 085	OTHER
12596	NW-26-60-26-W3	1974-to date	2 040	MULTI-PURPOSE
12494	NW-05-59-26-W3	1976-to date	109	OTHER
12819	NE-04-57-22-W3	1976-to date	201	OTHER
13050	NE-04-61-22-W3	1977-78	4	OTHER
13075	SW-10-61-22-W3	1977-78	4	OTHER
13219	NE-36-59-25-W3	1977-to date	43	OTHER
10908	SW-21-59-25-W3	1978-to date	152	OTHER
13396	SE-20-61-22-W3	1978-to date	62	OTHER
12817	SW-16-57-22-W3	1979-to date	16	OTHER
13463	SE-18-60-22-W3	1979-to date	17	OTHER
13462	NW-19-60-22-W3	1979-to date	11	OTHER
13460	SW-29-60-22-W3	1979-to date	14	OTHER
13461	SE-30-60-22-W3	1979-to date	259	OTHER
13464	NE-12-60-23-W3	1979-to date	68	OTHER
14646	SE-16-61-27-W3	1982-to date	90	IRRIGATION

TABLE A-6

CANCELLED PROJECTS

A - cancelled before Streamflow Records were taken on the Beaver River at Cold Lake Reserve.

<u>File No.</u>	<u>Location</u>	<u>Use</u>	<u>Authorized</u>	<u>Cancelled</u>
2476	NW12-64-03-04	Other	1935	1938
5126	SW21-65-14-04	Diversion	1938	1944

B - Projects cancelled after Streamflow Records were taken on the Beaver River at Cold Lake Reserve.

<u>File No.</u>	<u>Location</u>	<u>Use</u>	<u>Authorized</u>	<u>Cancelled</u>
12582	SW12-63-04-04	Industrial	1969	1979
12770	SE16-62-02-04	Industrial	1969	1979

C - Recorded Water Use on Files #12582 and 12770

	<u>Month</u>	<u>File 12582</u>	<u>File 12770</u>	<u>Total use</u> (in dam ³)
1969	January	0	7.7	7.7
	February	0	18.4	18.4
	March	0	18.2	18.2
	April	0	0	0
	May	4.9	0	4.9
	June	9.5	0	9.5
	July	10.8	0	10.8
	August	10.5	0	10.5
	September	4.9	0.3	5.2
	October	0.5	2.8	3.3
	November	0.7	2.8	3.5
	December	1.8	1.4	3.2
1970	January	1.2	8.5	9.7
	February	0.5	11.0	11.5
	March	0.3	16.1	16.4
	April	0	0	0
	May	-----Project Operations Terminated		

**RECORDED AND NATURAL
FLOW ARRAYS**

TABLE B-1

RECORDED MONTHLY FLOW OF THE BEAVER RIVER
 AT COLD LAKE RESERVE - STATION 06AD006
 (m³/sec)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	CUBIC-DAMS
1912	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1913	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1914	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1915	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1916	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1917	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1918	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1919	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1920	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1921	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1922	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1923	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1924	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1925	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1926	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1927	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1928	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1929	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1930	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1931	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1932	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1933	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1934	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1935	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1936	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1937	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1938	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1939	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1940	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1941	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1942	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1943	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1944	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1945	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1946	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1947	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1948	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1949	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1950	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1951	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1952	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1953	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1954	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-	-	-	10.20	3.33	2.11	-	-
1956	2.18	2.65	2.80	77.80	95.10	60.30	111.00	49.80	41.10	41.00	23.00	9.30	43.14	1364205.0
1957	4.76	2.94	3.09	30.20	39.70	18.10	15.00	12.70	11.30	18.10	13.10	6.95	14.72	464193.7
1958	5.75	5.07	4.95	86.60	52.40	19.90	7.73	3.50	7.39	10.60	5.92	2.03	17.62	555725.4
1959	1.29	1.11	2.25	17.10	14.00	16.20	26.90	11.80	42.20	33.80	23.10	7.14	16.44	518543.1
1960	3.93	0.91	1.87	37.00	67.60	78.90	71.40	97.00	77.80	40.70	25.50	15.50	43.28	1368609.0
1961	10.20	7.04	8.26	43.20	79.40	31.90	24.50	32.30	7.49	4.18	4.92	2.01	21.39	674676.2
1962	1.80	1.94	2.35	36.40	69.90	284.00	145.00	87.00	37.70	28.50	23.30	10.40	60.79	1917195.0
1963	7.07	5.52	5.53	115.00	112.00	44.50	20.00	9.81	7.45	5.89	2.48	1.42	28.08	885666.4
1964	0.89	0.60	1.70	15.20	32.10	12.30	6.10	10.50	21.90	20.20	9.24	3.50	11.21	354351.3
1965	3.88	3.37	2.69	26.50	85.00	118.00	53.80	15.50	29.70	18.40	11.20	7.44	31.35	988791.9
1966	3.25	3.59	4.90	48.20	34.70	46.50	20.40	16.90	26.00	10.40	7.55	4.42	18.88	595475.8
1967	4.56	4.07	3.75	17.20	72.60	23.60	10.30	10.60	3.93	3.43	3.90	1.64	13.39	422161.5
1968	1.30	1.80	3.81	12.30	7.89	6.29	4.03	4.25	11.60	24.20	10.60	3.20	7.61	240622.2
1969	1.94	1.85	3.78	80.40	60.80	25.20	11.90	13.80	14.80	24.50	11.30	6.97	21.47	677131.9
1970	4.01	3.16	3.69	53.30	40.90	21.80	164.00	71.10	63.50	53.70	34.10	17.60	44.59	1406114.0
1971	11.80	9.80	9.69	112.00	100.00	57.20	137.00	47.70	18.20	11.80	8.13	5.25	44.28	1396286.0
1972	3.59	3.72	4.38	40.40	77.00	20.20	9.72	7.57	5.02	7.00	4.43	2.19	15.48	489396.9
1973	2.54	3.59	2.51	15.40	21.40	53.40	39.40	50.30	54.50	46.10	27.10	17.80	27.93	880766.6
1974	10.90	8.91	8.67	154.00	248.00	81.00	45.10	23.90	21.80	19.80	12.30	7.81	53.73	1694481.0
1975	6.20	6.46	6.00	42.00	82.70	58.50	82.80	39.00	36.10	19.40	11.30	8.02	33.39	1052834.0
1976	7.90	6.89	6.05	36.10	17.50	18.00	65.10	28.50	26.70	13.40	6.62	3.76	19.76	624750.6
1977	4.72	4.70	4.33	21.30	33.40	25.50	15.30	20.70	14.30	22.10	10.20	4.86	15.17	478508.8
1978	4.99	4.99	5.49	33.00	40.30	85.70	20.30	9.79	32.70	29.90	11.20	7.35	23.78	749901.9
1979	5.82	5.13	8.19	40.40	81.60	68.10	41.40	19.60	18.30	13.70	8.14	4.53	26.33	830465.6
1980	3.80	3.03	3.05	32.60	12.50	7.41	4.64	29.40	31.80	27.70	11.70	5.99	14.46	457284.1
1981	4.50	4.78	9.54	24.50	15.50	8.98	23.70	9.25	3.66	2.98	2.70	2.16	9.39	295969.1
1982	1.50	1.40	1.59	12.40	26.00	11.20	10.30	7.03	4.72	3.47	2.27	1.90	7.02	221390.3
MIN	0.89	0.60	1.59	12.30	7.89	6.29	4.03	3.50	3.66	2.98	2.27	1.42	7.02	221390.3
MAX	11.80	9.80	9.69	154.00	248.00	284.00	164.00	97.00	77.80	53.70	34.10	17.80	60.79	1917195.0
MEAN	4.63	4.03	4.63	46.69	60.00	48.25	43.96	27.38	24.88	20.18	11.74	6.19	25.36	800200.9

TABLE B-2

RECORDED MONTHLY FLOW OF THE BEAVER RIVER
NEAR DORINTOSH, SASKATCHEWAN - STATION 06AD001

(m³/sec)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	CUBIC-DAMS
1912	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1913	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1914	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1915	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1916	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1917	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1918	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1919	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1920	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1921	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1922	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1923	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1924	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1925	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1926	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1927	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1928	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1929	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1930	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1931	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1932	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1933	-	-	-	-	115.00	62.10	48.20	36.40	20.40	-	-	-	-	-
1934	-	-	-	-	57.80	38.40	59.50	30.70	14.30	14.60	-	-	-	-
1935	-	-	-	-	111.00	53.20	38.00	83.50	37.60	27.00	-	-	-	-
1936	-	-	-	-	127.00	50.20	26.50	13.20	13.00	16.10	-	-	-	-
1937	-	-	-	-	27.70	13.20	9.30	8.56	8.85	6.86	-	-	-	-
1938	-	-	-	-	25.40	9.01	3.94	2.95	2.61	2.18	-	-	-	-
1939	-	-	-	-	32.90	19.10	18.20	7.76	3.37	3.39	-	-	-	-
1940	-	-	-	-	15.70	13.50	10.20	6.81	4.52	2.64	-	-	-	-
1941	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1942	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1943	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1944	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1945	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1946	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1947	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1948	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1949	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1950	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1951	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1952	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1953	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1954	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1956	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1957	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1958	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1959	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1960	-	-	-	140.00	98.10	119.00	118.00	-	-	-	-	-	-	-
1961	-	-	-	87.70	102.00	47.80	37.00	51.80	24.30	-	-	-	-	-
1962	-	-	-	61.20	87.70	325.00	179.00	127.00	66.70	44.20	31.30	-	-	-
1963	-	-	6.23	114.00	164.00	64.20	28.40	15.30	10.30	6.55	-	-	-	-
1964	-	-	2.85	16.40	37.30	17.00	8.17	14.40	21.20	24.70	-	-	-	-
1965	-	-	4.92	42.50	107.00	172.00	100.00	29.90	36.80	26.80	-	-	-	-
1966	-	-	3.80	57.20	43.50	55.30	22.70	18.90	25.60	13.50	-	-	-	-
1967	-	-	4.48	7.88	69.20	28.00	13.00	11.60	6.25	4.38	-	-	-	-
1968	-	-	2.97	15.50	12.20	9.42	5.34	6.67	9.26	23.50	-	-	-	-
1969	-	-	3.74	87.80	81.60	35.90	16.00	16.60	15.60	24.10	-	-	-	-
1970	-	-	5.38	75.70	64.00	31.00	181.00	100.00	65.90	57.50	-	-	-	-
1971	-	-	11.70	98.30	159.00	63.60	155.00	60.50	26.70	16.00	11.10	6.97	-	-
1972	6.73	5.31	7.18	62.70	109.00	30.70	13.80	9.36	7.35	9.08	6.80	3.72	22.69	717590.1
1973	3.41	4.24	3.42	28.80	35.30	58.90	54.80	54.70	62.50	51.80	49.30	22.70	35.93	1133027.0
1974	13.40	11.80	10.20	137.00	372.00	152.00	59.50	36.80	29.20	24.30	15.80	14.20	73.40	2314896.0
1975	8.67	7.83	8.76	43.80	129.00	82.50	110.00	47.80	40.90	26.30	11.90	12.60	44.46	1402207.0
1976	10.90	9.72	7.95	47.10	24.50	17.90	68.50	42.80	30.50	16.40	8.40	4.63	24.17	764203.2
1977	4.98	4.90	4.88	28.50	39.30	33.40	16.30	20.80	14.90	18.10	9.63	6.00	16.85	531467.9
1978	5.59	5.82	7.66	32.10	62.70	97.10	23.40	13.10	26.80	32.20	12.60	6.03	27.10	854671.4
1979	4.17	4.70	5.59	43.10	120.00	85.60	52.30	28.00	21.70	17.80	9.66	6.24	33.40	1053257.0
1980	5.19	2.98	3.42	44.20	20.00	10.40	6.75	29.20	34.50	34.20	16.50	7.00	17.85	564449.1
1981	5.62	5.88	10.30	46.40	23.80	10.30	25.60	11.50	4.78	3.73	3.48	2.35	12.83	404639.8
1982	2.14	1.76	1.78	24.80	37.20	18.10	13.40	12.00	5.89	5.34	2.92	2.32	10.69	336973.7
MIN	2.14	1.76	1.78	7.88	12.20	9.01	3.94	2.95	2.61	2.18	2.92	2.32	10.69	336973.7
MAX	13.40	11.80	11.70	140.00	372.00	325.00	181.00	127.00	66.70	57.50	49.30	22.70	73.40	2314896.0
MEAN	6.44	5.90	5.86	58.38	81.00	58.83	49.09	31.62	23.08	19.76	14.57	7.90	29.03	916125.3

TABLE B-3

**NATURAL MONTHLY FLOW OF THE BEAVER RIVER
AT COLD LAKE RESERVE
(m³/sec)**

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	CUBIC-DAMS
1912	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1913	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1914	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1915	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1916	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1917	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1918	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1919	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1920	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1921	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1922	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1923	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1924	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1925	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1926	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1927	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1928	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1929	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1930	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1931	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1932	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1933	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1934	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1935	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1936	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1937	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1938	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1939	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1940	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1941	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1942	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1943	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1944	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1945	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1946	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1947	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1948	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1949	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1950	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1951	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1952	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1953	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1954	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-	-	-	10.20	3.33	2.11	-	-
1956	2.18	2.65	2.80	77.94	95.28	60.44	111.00	49.80	41.10	41.00	23.00	9.30	43.18	1365416.0
1957	4.76	2.94	3.09	30.34	39.88	18.24	15.00	12.70	11.30	18.10	13.10	6.95	14.76	465407.7
1958	5.75	5.07	4.95	86.74	52.58	20.04	7.73	3.50	7.39	10.60	5.92	2.03	17.66	556939.1
1959	1.29	1.11	2.25	17.24	14.18	16.34	26.90	11.80	42.20	33.80	23.10	7.14	16.48	519757.0
1960	3.93	0.91	1.87	37.14	67.78	79.04	71.40	97.00	77.80	40.70	25.50	15.50	43.32	1369822.0
1961	10.20	7.04	8.26	43.34	79.58	32.04	24.50	32.30	7.49	4.18	4.92	2.01	21.43	675890.2
1962	1.80	1.94	2.35	36.54	70.08	284.14	145.00	87.00	37.70	28.50	23.30	10.40	60.83	1918408.0
1963	7.07	5.52	5.53	115.14	112.18	44.64	20.00	9.81	7.45	5.89	2.48	1.42	28.12	886880.1
1964	0.89	0.60	1.70	15.34	32.28	12.44	6.10	10.50	21.90	20.20	9.24	3.50	11.24	355564.9
1965	3.88	3.37	2.69	26.69	85.25	118.19	53.80	15.50	29.70	18.40	11.20	7.44	31.41	990436.9
1966	3.25	3.59	4.90	48.39	34.95	46.69	20.40	16.90	26.00	10.40	7.55	4.42	18.93	597120.8
1967	4.56	4.07	3.75	17.46	72.94	23.86	10.30	10.60	3.93	3.43	3.90	1.64	13.46	424423.1
1968	1.30	1.80	3.81	12.58	8.25	6.57	4.03	4.25	11.60	24.20	10.60	3.20	7.69	243035.9
1969	1.94	1.86	3.79	80.69	61.18	25.50	11.90	13.80	14.80	24.50	11.30	6.97	21.55	679747.2
1970	4.01	3.16	3.70	53.64	41.33	22.14	164.00	71.10	63.50	53.70	34.10	17.60	44.68	1409049.0
1971	11.80	9.80	9.69	112.34	100.43	57.54	137.00	47.70	18.20	11.80	8.13	5.25	44.37	1399183.0
1972	3.59	3.72	4.38	40.74	77.43	20.54	9.72	7.57	5.02	7.00	4.43	2.19	15.57	492294.0
1973	2.54	3.59	2.51	15.75	21.85	53.75	39.40	50.30	54.50	46.10	27.10	17.80	28.02	883750.1
1974	10.90	8.91	8.67	154.35	248.45	81.35	45.10	23.90	21.80	19.80	12.30	7.81	53.83	1697464.0
1975	6.20	6.46	6.00	42.35	83.15	58.85	82.80	39.00	36.10	19.40	11.30	8.02	33.48	1055818.0
1976	7.90	6.89	6.05	36.45	17.95	18.35	65.10	28.50	26.70	13.40	6.62	3.76	19.85	627734.1
1977	4.72	4.70	4.33	21.67	33.87	25.87	15.30	20.70	14.30	22.10	10.20	4.86	15.27	481665.4
1978	4.99	4.99	5.49	33.49	40.94	86.19	20.30	9.79	32.70	29.90	11.20	7.35	23.91	754169.6
1979	5.82	5.13	8.19	40.89	82.24	68.59	41.40	19.60	18.30	13.70	8.14	4.53	26.47	834733.6
1980	3.80	3.03	3.05	33.09	13.14	7.90	4.64	29.40	31.80	27.70	11.70	5.99	14.60	461552.1
1981	4.50	4.78	9.54	25.01	16.16	9.49	23.70	9.25	3.66	2.98	2.70	2.16	9.53	300395.2
1982	1.50	1.40	1.59	12.91	26.66	11.71	10.30	7.03	4.72	3.47	2.27	1.90	7.16	225816.5
MIN	0.89	0.60	1.59	12.58	8.25	6.57	4.03	3.50	3.66	2.98	2.27	1.42	7.16	225816.5
MAX	11.80	9.80	9.69	154.35	248.45	284.14	164.00	97.00	77.80	53.70	34.10	17.80	60.83	1918408.0
MEAN	4.63	4.03	4.63	46.97	60.37	48.53	43.96	27.38	24.88	20.18	11.74	6.19	25.43	802681.4

TABLE B-4

**NATURAL MONTHLY FLOW OF THE BEAVER RIVER
NEAR DORINTOSH, SASKATCHEWAN
(m³/sec)**

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	CUBIC-DAMS
1912	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1913	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1914	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1915	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1916	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1917	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1918	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1919	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1920	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1921	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1922	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1923	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1924	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1925	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1926	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1927	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1928	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1929	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1930	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1931	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1932	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1933	-	-	-	-	115.07	62.15	48.20	36.40	20.40	-	-	-	-	-
1934	-	-	-	-	57.87	38.45	59.50	30.70	14.30	14.60	-	-	-	-
1935	-	-	-	-	111.07	53.25	38.00	83.50	37.60	27.00	-	-	-	-
1936	-	-	-	-	127.07	50.25	26.50	13.20	13.00	16.10	-	-	-	-
1937	-	-	-	-	27.77	13.25	9.30	8.56	8.85	6.86	-	-	-	-
1938	-	-	-	-	25.47	9.06	3.94	2.95	2.61	2.18	-	-	-	-
1939	-	-	-	-	32.97	19.15	18.20	7.76	3.37	3.39	-	-	-	-
1940	-	-	-	-	15.77	13.55	10.20	6.81	4.52	2.64	-	-	-	-
1941	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1942	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1943	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1944	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1945	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1946	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1947	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1948	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1949	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1950	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1951	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1952	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1953	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1954	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1956	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1957	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1958	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1959	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1960	-	-	-	140.14	98.28	119.14	118.00	-	-	-	-	-	-	-
1961	-	-	-	87.84	102.18	47.94	37.00	51.80	24.30	-	-	-	-	-
1962	-	-	-	61.34	87.88	325.14	179.00	127.00	66.70	44.20	31.30	-	-	-
1963	-	-	6.23	114.14	164.18	64.34	28.40	15.30	10.30	6.55	-	-	-	-
1964	-	-	2.85	16.54	37.48	17.14	8.17	14.40	21.20	24.70	-	-	-	-
1965	-	-	4.92	42.69	107.25	172.19	100.00	29.90	36.80	26.80	-	-	-	-
1966	-	-	3.80	57.39	43.75	55.49	22.70	18.90	25.60	13.50	-	-	-	-
1967	-	-	4.48	8.14	69.54	28.26	13.00	11.60	6.25	4.38	-	-	-	-
1968	-	-	2.97	15.78	12.56	9.70	5.34	6.67	9.26	23.50	-	-	-	-
1969	-	-	3.75	88.09	81.98	36.20	16.00	16.60	15.60	24.10	-	-	-	-
1970	-	-	5.39	76.04	64.43	31.34	181.00	100.00	65.90	57.50	-	-	-	-
1971	-	-	11.70	98.64	159.43	63.94	155.00	60.50	26.70	16.00	11.10	6.97	-	-
1972	6.73	5.31	7.18	63.04	109.44	31.04	13.80	9.36	7.35	9.08	6.80	3.72	22.78	720503.4
1973	3.41	4.24	3.42	29.22	35.84	59.32	54.80	54.70	62.50	51.80	49.30	22.70	36.04	1136627.0
1974	13.40	11.80	10.20	137.78	373.00	152.78	59.50	36.80	29.20	24.30	15.80	14.20	73.62	2321620.0
1975	8.67	7.83	8.76	44.58	130.00	83.28	110.00	47.80	40.90	26.30	11.90	12.60	44.68	1408932.0
1976	10.90	9.72	7.95	47.91	25.55	18.71	68.50	42.80	30.50	16.40	8.40	4.63	24.39	771238.7
1977	4.98	4.90	4.88	29.34	40.38	34.24	16.30	20.80	14.90	18.10	9.63	6.00	17.08	538727.2
1978	5.59	5.82	7.66	33.09	63.98	98.09	23.40	13.10	26.80	32.20	12.60	6.03	27.37	863256.4
1979	4.17	4.70	5.59	44.14	121.34	86.64	52.30	28.00	21.70	17.80	9.66	6.24	33.68	1062219.0
1980	5.19	2.98	3.42	45.24	21.34	11.44	6.75	29.20	34.50	34.20	16.50	7.00	18.13	573410.7
1981	5.62	5.88	10.30	47.46	25.16	11.36	25.60	11.50	4.78	3.73	3.48	2.35	13.12	413759.7
1982	2.14	1.76	1.78	25.87	38.58	19.17	13.40	12.00	5.89	5.34	2.92	2.32	10.98	346183.9
MIN	2.14	1.76	1.78	8.14	12.56	9.06	3.94	2.95	2.61	2.18	2.92	2.32	10.98	346183.9
MAX	13.40	11.80	11.70	140.14	373.00	325.14	181.00	127.00	66.70	57.50	49.30	22.70	73.62	2321620.0
MEAN	6.44	5.90	5.86	58.89	81.50	59.23	49.09	31.62	23.08	19.76	14.57	7.90	29.26	923313.8

TABLE B-5

NATURAL MONTHLY FLOW OF THE NORTH SASKATCHEWAN RIVER
AT EDMONTON, ALBERTA

(m³/sec)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	CUBIC-DAMS
1912	35.6	37.6	37.3	131.1	338.1	517.1	967.7	749.3	364.8	202.9	90.0	47.6	294.8	9323752.
1913	39.5	37.2	37.2	233.1	275.5	560.5	607.7	524.2	267.1	128.5	66.8	30.0	235.0	7412012.
1914	34.4	27.0	32.2	84.5	256.8	697.4	534.9	314.3	183.9	129.1	70.0	31.2	200.4	6320143.
1915	34.7	30.6	47.5	94.1	237.1	1077.4	1208.8	667.5	291.7	160.7	85.3	48.6	333.9	10529011.
1916	34.9	32.8	49.8	135.3	196.2	724.7	828.6	591.9	469.5	212.4	121.6	73.2	289.8	9165408.
1917	57.7	39.6	37.9	139.8	723.0	716.0	582.2	372.4	241.2	167.1	98.4	51.9	270.5	8530163.
1918	55.4	35.0	54.4	197.1	185.6	550.9	479.4	399.9	238.2	144.8	74.3	40.9	205.4	6477169.
1919	35.2	28.5	24.8	90.3	165.7	265.9	340.9	418.9	276.6	105.7	46.4	32.8	153.5	4839952.
1920	33.4	32.8	33.1	79.7	661.4	468.5	699.2	417.0	184.1	97.5	59.3	28.7	234.4	7411256.
1921	33.1	31.5	32.2	177.2	329.4	428.4	437.4	371.5	127.3	78.1	39.8	29.1	177.3	5589887.
1922	22.5	22.9	25.5	69.1	247.6	420.6	409.8	472.3	246.5	115.8	49.7	21.8	178.1	5615350.
1923	20.1	26.8	25.1	82.5	158.8	968.8	683.2	544.7	302.9	142.6	74.1	61.0	258.4	8147497.
1924	26.1	27.6	31.1	58.9	357.0	411.9	485.0	490.2	271.7	127.2	56.5	34.7	199.1	6295157.
1925	28.8	26.6	28.2	355.0	278.8	548.6	516.5	766.9	476.9	265.7	81.6	71.8	288.4	9094922.
1926	41.0	39.5	51.3	181.8	174.7	382.0	453.6	323.1	774.4	294.1	127.9	39.1	240.5	7583565.
1927	44.2	41.6	58.8	269.5	342.6	682.6	785.3	525.8	328.7	193.4	72.0	54.1	284.6	8975128.
1928	69.4	66.4	89.4	156.8	235.9	915.0	944.7	423.3	220.3	112.4	64.0	43.4	278.9	8819878.
1929	29.9	28.0	36.3	65.9	260.7	463.3	284.1	303.0	193.9	93.7	47.7	32.8	153.9	4852524.
1930	29.8	31.9	43.6	122.6	204.6	448.8	443.8	351.9	225.0	109.0	53.8	41.5	176.3	5559786.
1931	30.4	27.1	27.7	69.6	182.0	398.0	585.4	367.7	240.0	124.6	64.6	54.6	182.1	5742931.
1932	40.6	31.5	27.2	155.8	315.3	839.9	435.2	421.5	249.9	121.9	61.7	41.0	228.5	7224421.
1933	43.5	34.8	32.7	140.9	447.2	475.6	466.9	372.2	251.7	91.3	44.9	30.3	203.8	6425940.
1934	39.1	35.3	67.3	158.3	282.5	410.0	322.1	292.2	162.4	105.1	54.5	40.7	164.8	5198116.
1935	22.6	27.3	26.7	156.5	278.8	534.7	831.4	491.2	227.5	114.2	98.1	34.9	238.5	7522167.
1936	34.7	32.9	24.7	340.4	407.9	496.8	345.5	345.9	196.8	101.0	60.4	25.6	201.2	6361653.
1937	16.7	16.4	24.9	66.0	207.7	362.1	514.2	323.2	221.8	119.9	87.5	48.0	168.4	5311334.
1938	37.4	21.7	30.9	76.2	176.1	575.3	610.3	424.9	343.9	155.8	68.3	40.4	214.4	6762381.
1939	36.4	31.0	54.4	100.8	183.7	438.0	487.1	346.5	193.9	122.5	82.0	42.3	177.4	5596031.
1940	27.6	23.2	29.0	251.3	297.1	331.4	404.6	289.8	256.2	128.4	49.9	38.7	177.6	4495649.
1941	28.0	29.2	31.2	70.5	96.6	317.2	401.6	341.9	184.0	117.2	51.1	32.9	142.6	4495649.
1942	31.1	28.9	24.6	91.4	187.0	530.7	707.2	486.1	307.9	153.0	80.1	57.2	225.1	7097273.
1943	45.5	34.7	36.2	320.0	163.6	483.5	560.5	385.5	186.2	102.4	43.9	25.3	199.6	6295832.
1944	28.6	29.1	35.4	95.5	218.5	1041.8	651.7	551.1	273.6	142.9	70.3	31.1	264.3	8356445.
1945	34.6	33.0	37.4	63.9	242.8	410.3	401.5	327.0	185.8	179.8	73.9	50.4	171.0	5393043.
1946	44.0	39.2	41.5	130.6	224.5	720.6	472.0	299.9	214.0	102.9	38.0	55.8	199.0	6277137.
1947	47.2	40.2	49.8	217.1	283.6	510.7	528.0	334.4	250.8	153.3	97.6	55.1	214.8	6774180.
1948	46.6	39.2	41.1	196.9	1126.3	718.2	543.0	559.4	233.5	114.3	56.6	26.5	310.0	9803450.
1949	33.5	32.6	33.0	119.2	165.4	245.5	432.6	319.3	165.5	89.0	59.0	19.6	143.7	4531955.
1950	24.1	26.0	28.0	97.8	165.6	555.4	568.3	349.4	206.8	95.1	40.4	38.6	183.8	5795884.
1951	30.5	26.7	27.5	97.6	466.5	406.5	625.6	361.3	288.0	156.8	92.8	56.3	221.2	6977145.
1952	53.6	46.4	48.7	290.3	210.2	944.4	668.4	453.8	239.1	137.3	63.1	27.1	265.1	8382916.
1953	36.4	39.7	37.8	89.5	351.2	784.0	591.2	509.5	263.6	115.0	73.1	37.6	245.1	7729105.
1954	36.8	42.5	33.6	77.4	534.6	969.3	636.6	864.2	700.9	243.0	129.3	74.5	363.3	11458296.
1955	46.8	53.0	45.4	178.2	372.4	555.1	501.8	267.8	178.0	82.6	38.1	37.7	197.1	6216949.
1956	35.0	29.9	30.3	213.9	228.9	471.3	447.0	329.8	189.1	101.4	101.4	31.8	180.0	5692657.
1957	30.9	25.6	32.1	110.5	383.9	400.0	302.8	276.5	225.1	152.5	97.9	52.1	175.0	5518936.
1958	43.8	38.7	38.9	153.0	390.0	570.2	680.7	363.9	208.2	103.5	51.0	37.9	224.6	7082655.
1959	34.9	32.9	43.7	77.5	181.7	635.7	546.1	293.7	207.6	137.8	76.0	57.0	194.4	6131553.
1960	41.5	40.2	68.9	123.3	233.9	386.0	618.9	347.7	159.3	103.0	50.9	35.5	184.9	5847735.
1961	36.4	33.3	48.7	71.2	258.6	488.0	389.7	426.0	176.6	138.7	62.8	40.9	181.9	5736905.
1962	40.9	39.1	35.4	189.2	192.5	391.8	476.9	436.1	245.2	118.1	70.9	37.5	190.3	6001953.
1963	25.0	33.2	57.9	238.2	269.4	467.3	554.0	387.7	258.9	130.0	45.5	40.8	210.0	6621290.
1964	40.0	38.8	33.0	92.4	385.6	713.7	573.5	281.1	320.1	216.7	82.6	47.0	235.7	7453992.
1965	51.2	41.2	47.0	315.1	323.4	1077.5	1102.5	509.3	384.5	235.0	95.7	54.9	354.4	11176681.
1966	51.3	57.4	53.6	174.5	273.5	381.3	685.1	572.5	291.4	178.0	68.3	45.7	237.6	7492850.
1967	46.0	50.4	44.0	117.6	268.0	842.6	481.6	349.2	224.3	111.3	55.6	25.9	218.4	6887812.
1968	40.3	37.1	63.8	74.5	185.3	409.7	547.2	413.5	232.3	136.8	52.3	23.0	185.4	5861958.
1969	42.4	49.6	42.0	190.6	264.2	472.1	735.7	506.3	223.0	131.5	74.7	28.9	231.5	7299217.
1970	29.7	40.2	45.9	162.8	237.5	594.8	426.1	287.3	135.8	94.1	27.6	35.3	177.0	5580445.
1971	35.9	36.9	32.4	251.3	262.2	651.1	518.8	400.3	175.3	91.1	48.2	15.9	210.6	6641103.
1972	32.6	31.7	51.2	149.3	256.0	1009.7	615.4	269.9	148.4	122.1	63.0	23.8	231.0	7303575.
1973	48.1	44.4	52.0	219.7	423.5	497.8	444.9	327.5	181.3	110.1	32.9	32.8	202.2	6376314.
1974	11.6	43.4	36.2	394.5	441.1	641.7	531.9	334.4	202.5	135.5	54.9	26.7	238.5	7522199.
1975	15.0	16.9	27.5	114.2	214.8	268.7	436.4	234.1	125.5	72.4	26.5	36.4	133.3	5345617.
1976	22.4	26.9	47.0	149.2	203.0	273.4	427.5	469.4	234.0	96.6	48.3	22.6	169.0	4203772.
1977	30.1	27.4	44.1	105.6	414.3	469.8	326.4	379.6	242.7	120.5	35.6	25.0	186.1	5868130.
1978	21.5	62.2	67.1	144.7	265.7	640.2	653.4	351.9	364.3	138.8	64.2	39.7	235.1	7415236.
1979	14.2	16.7	95.4	116.2	257.6	350.5	353.4	296.0	172.5	95.1	28.9	16.3	152.0	4793298.
1980	0.0	0.0	31.6	222.6	310.3	993.5	533.9	311.7	295.1	140.9	59.9	5.6	241.8	7645000.
1981	34.7	52.0	67.7	100.9	394.8	358.3	787.8	572.5	232.1	109.2	68.9	18.6	235.1	7413805.
1982	5.3	49.9	52.2	169.8	224.6	484.2	885.0	321.5	243.2	154.7	36.4	44.7	223.9	7061881.
MIN	0.0	0.0	24.6	58.9	96.6	245.5	284.1	234.1	125.5	72.4	26.5	5.6	133.3	4203772.
MAX	69.4	66.4	95.4	394.5	1126.3	1077.5	1208.8	864.2	774.4	294.1	129.3	74.5	363.3	11458296.
MEAN	34.7	34.7	41.7	152.4	295.2	566.8	564.3	410.7	253.6	134.2	64.6	38.6	216.8	6843110.

TABLE B-6


NATURAL MONTHLY FLOW OF THE NORTH SASKATCHEWAN RIVER
AT PRINCE ALBERT, SASKATCHEWAN
(m³/sec)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	CUBIC-DAMS
1912	42.6	44.8	44.7	231.1	319.5	420.9	1000.0	851.2	631.4	284.0	139.2	65.6	341.0	10783810.
1913	47.2	44.9	56.2	462.7	344.2	539.8	741.8	710.9	413.1	201.5	85.7	51.6	309.7	9767643.
1914	34.6	33.7	36.7	123.2	375.1	859.5	834.4	412.2	292.0	219.9	105.8	71.8	284.6	8975593.
1915	49.8	46.9	48.3	256.2	198.4	708.6	1706.0	796.3	425.0	216.7	110.3	63.4	388.4	12248235.
1916	40.3	31.7	36.6	210.4	265.2	683.1	932.6	710.5	651.9	327.0	173.7	89.2	346.8	10967226.
1917	62.3	57.1	50.4	246.5	746.9	855.1	635.2	405.8	286.9	196.3	114.2	40.9	309.5	9758992.
1918	53.2	47.3	49.0	246.4	216.3	446.7	479.3	352.0	231.3	180.2	78.0	39.7	202.3	6381249.
1919	34.0	34.6	24.7	154.5	154.3	215.9	335.7	424.4	318.9	125.5	58.7	45.7	161.3	5087410.
1920	41.1	35.5	36.6	107.4	893.9	692.7	828.2	502.2	251.8	149.9	93.1	42.7	308.0	5087410.
1921	27.0	31.7	27.4	402.3	437.0	484.3	447.7	405.7	208.0	100.0	63.0	39.6	223.6	7052998.
1922	24.5	22.1	28.7	145.8	317.8	413.3	402.7	446.6	318.1	161.5	75.0	21.7	199.2	6280696.
1923	25.2	23.8	23.6	98.4	177.9	744.5	828.6	582.3	384.3	197.0	95.8	77.4	273.0	8607890.
1924	28.9	43.1	49.4	109.6	337.6	372.8	452.7	441.2	325.4	147.6	63.1	53.2	202.7	6411349.
1925	42.8	38.8	36.0	508.3	305.9	477.6	490.7	642.1	508.6	293.1	112.2	71.9	294.9	9300505.
1926	48.5	34.8	51.3	282.8	204.5	281.0	484.9	328.6	731.8	339.4	154.6	74.3	251.9	7945068.
1927	42.9	41.6	62.0	296.3	631.4	601.5	827.0	618.0	400.0	242.5	107.5	59.0	329.6	10393103.
1928	77.4	48.9	68.9	291.9	268.7	747.1	969.8	508.2	264.8	131.9	63.9	45.7	291.4	9213484.
1929	34.2	27.5	39.2	119.3	225.6	531.2	263.6	301.9	198.7	119.1	56.4	37.5	163.3	5148755.
1930	33.9	35.7	43.8	160.8	194.1	410.4	504.2	393.6	251.4	123.9	50.4	38.4	187.6	5916531.
1931	27.6	26.3	31.8	111.7	155.1	336.0	651.3	434.6	300.8	142.2	74.1	51.1	196.5	6196521.
1932	42.6	34.2	30.0	278.2	407.8	814.0	487.2	401.0	321.0	144.9	57.0	46.2	255.3	8073944.
1933	46.5	39.5	31.5	142.3	506.9	493.8	497.3	353.3	293.8	110.3	52.6	41.5	218.6	6893612.
1934	38.1	42.7	56.7	223.5	268.5	462.4	334.6	302.0	215.0	127.9	68.8	42.5	182.4	5751291.
1935	20.7	23.9	30.6	130.1	355.3	496.8	808.1	590.8	269.7	138.2	81.0	58.6	252.2	7954707.
1936	35.6	30.6	26.6	379.0	582.8	527.3	358.5	351.1	241.9	117.6	59.4	40.3	229.5	7257831.
1937	19.7	19.1	24.6	121.9	153.2	306.6	455.2	351.8	200.2	153.2	93.5	32.2	161.9	5105175.
1938	27.8	23.9	38.5	165.8	124.0	420.7	637.7	400.7	359.2	190.9	79.2	48.1	210.7	6645433.
1939	39.6	34.0	40.2	166.5	143.6	303.8	501.9	348.1	228.2	127.3	82.4	48.7	172.9	5452736.
1940	29.8	27.1	27.2	242.8	398.4	321.6	360.7	309.9	258.0	142.2	69.1	39.9	186.0	5882278.
1941	27.1	29.6	25.2	124.0	82.9	200.5	367.1	308.1	231.0	138.3	76.0	20.9	136.5	4305432.
1942	20.7	23.7	25.4	125.3	128.3	507.8	725.8	528.6	362.9	187.9	81.8	62.1	233.0	7347482.
1943	54.5	43.2	44.9	477.2	280.0	397.9	660.7	424.6	248.5	150.7	78.6	32.0	242.0	7673300.
1944	24.2	29.3	33.3	171.6	161.5	1054.7	-	-	-	192.1	84.7	31.3	-	-
1945	30.3	36.4	38.7	90.7	172.9	402.1	410.5	333.4	258.7	197.3	72.7	60.1	176.1	5554169.
1946	48.5	44.0	52.7	202.7	159.8	627.7	561.9	319.9	239.0	125.8	69.0	41.3	208.2	6565600.
1947	37.9	35.2	34.1	280.8	324.8	457.1	508.9	366.5	278.2	190.5	96.5	70.7	224.4	7076067.
1948	50.6	41.5	39.6	196.4	1512.9	946.1	572.0	563.1	304.4	151.5	62.9	38.2	375.0	11859452.
1949	40.0	33.0	34.4	168.3	152.6	253.8	303.1	354.9	211.2	105.4	47.5	28.0	145.0	4572148.
1950	19.5	26.6	27.4	139.6	183.1	429.4	605.1	377.7	234.4	129.7	51.5	33.1	189.1	5964650.
1951	33.3	26.4	26.0	384.7	539.4	409.6	579.8	405.6	328.1	163.4	77.6	60.3	254.2	8016267.
1952	44.1	38.7	37.0	464.6	254.2	711.4	824.3	502.5	259.3	178.1	98.7	40.6	288.1	9110614.
1953	29.9	31.9	39.3	113.1	371.1	710.2	673.7	520.9	409.1	156.2	88.7	43.6	266.9	8415510.
1954	34.2	37.3	38.5	90.9	468.1	1110.4	744.0	675.9	1115.2	353.0	157.0	96.7	410.9	12957552.
1955	54.8	60.0	43.7	412.1	560.1	626.2	561.0	336.2	215.2	122.1	45.3	31.9	256.6	8091154.
1956	33.5	31.5	29.1	491.0	501.4	528.7	486.4	393.4	259.0	162.6	80.1	38.7	253.2	8007162.
1957	35.3	25.7	27.2	222.1	425.4	417.5	305.2	292.7	238.7	156.0	103.0	53.8	192.7	6075831.
1958	36.9	40.1	36.8	348.4	354.1	571.6	695.2	392.2	267.3	132.9	81.7	28.1	249.7	7875775.
1959	25.1	32.2	30.4	156.1	139.7	485.5	626.8	384.3	230.1	182.4	86.2	52.8	203.6	6421674.
1960	28.7	38.6	37.6	293.1	217.4	349.1	673.5	396.8	180.8	142.6	71.1	30.9	205.7	6505471.
1961	36.1	33.0	31.0	163.3	190.3	540.4	363.0	513.3	251.2	115.0	51.7	25.9	193.5	6102820.
1962	45.8	45.4	53.0	223.4	260.6	430.7	538.7	460.6	239.8	121.3	102.8	67.6	216.8	6838359.
1963	17.2	25.5	47.3	497.6	386.8	460.0	541.6	452.8	309.3	174.3	52.2	26.8	250.2	7891570.
1964	30.7	36.1	30.2	159.6	359.1	616.9	671.5	330.6	286.3	312.3	92.0	57.2	249.3	7882303.
1965	41.4	17.3	36.9	437.5	521.2	950.5	1347.4	600.8	385.3	344.2	114.6	74.9	408.5	12881553.
1966	43.0	56.8	50.9	287.7	284.0	405.0	627.7	602.9	352.6	211.1	72.7	49.2	255.0	8040648.
1967	37.6	44.9	45.5	53.4	391.8	636.4	571.3	379.6	259.6	166.5	67.1	11.8	223.2	7039801.
1968	1.7	21.5	100.0	216.1	141.7	383.9	519.1	510.3	288.9	171.3	84.2	24.2	205.8	6508824.
1969	24.5	44.3	28.9	431.6	347.2	435.9	761.8	530.0	288.7	190.7	70.2	35.2	267.1	8423956.
1970	23.3	30.9	47.3	316.9	306.8	540.5	570.9	353.4	207.2	104.2	42.1	14.7	214.0	6748244.
1971	34.8	35.3	30.5	406.7	463.7	663.0	593.0	533.9	231.4	129.2	44.7	19.7	266.6	8407669.
1972	23.0	20.7	27.5	357.2	367.6	677.7	873.9	404.6	173.1	158.5	75.0	12.5	265.0	8379573.
1973	41.8	20.2	52.6	321.3	420.0	541.7	561.0	384.4	256.5	148.6	48.6	43.3	237.8	7500486.
1974	19.9	60.0	72.2	729.4	1141.1	786.3	751.0	439.1	282.1	180.2	86.5	40.4	384.0	12110670.
1975	4.9	29.7	38.5	115.6	386.4	338.4	455.1	283.7	173.3	90.7	14.0	4.4	162.3	5118791.
1976	25.3	27.6	43.0	238.1	220.5	266.2	424.3	472.5	280.7	133.9	30.4	4.8	181.2	5729669.
1977	7.8	27.8	42.7	179.2	355.8	551.2	381.1	385.0	311.8	185.6	55.0	16.9	209.1	6593718.
1978	14.8	44.9	41.1	285.8	290.7	630.1	706.9	413.7	413.0	208.8	87.3	36.2	265.3	8365360.
1979	0.0	12.9	68.9	237.5	520.3	395.1	422.5	344.7	218.4	123.4	59.9	8.7	202.3	6378922.
1980	3.1	11.0	17.0	355.1	308.6	837.7	669.8	366.1	321.4	219.3	117.7	61.7	274.0	8664558.
1981	47.7	53.0	62.2	229.4	362.9	468.5	575.1	762.2	296.4	147.6	90.7	42.7	263.1	8298530.
1982	3.4	22.4	16.7	147.5	429.5	450.7	902.6	456.1	292.3	212.2	81.7	48.6	257.3	8115621.
MIN	0.0	11.0	16.7	53.4	82.9	200.5	263.6	283.7	173.1	90.7	14.0	4.4	136.5	4305432.
MAX	77.4	60.0	100.0	729.4	1512.9	1110.4	1706.0	851.2	1115.2	353.0	173.7	96.7	410.9	12957552.
MEAN	33.2	34.5	40.0	250.1	354.3	537.6	613.9	450.5	311.0	173.5	79.8	43.7	244.3	7708064.

TABLE B-7

NATURAL MONTHLY FLOW EXTENDED TO COVER THE PERIOD
1912-1982 FOR BEAVER RIVER AT COLD LAKE RESERVE

(m³/sec)

PRIORITY NO. 1 

	Intercept	Independent Variables			R=Coeff. of Corr.	Se=Std. Error of Estimate
		B6AD1				
Jan.						
Feb.						
Mar.						
Apr.						
May	-0.1555	1.0050		0.986	0.059	
Jun.	-0.1263	0.9994		0.988	0.066	
Jul.	-0.1136	1.0005		0.991	0.064	
Aug.	-0.1079	0.9866		0.976	0.078	
Sep.	-0.1062	1.0117		0.939	0.130	
Oct.	-0.1316	1.0383		0.983	0.068	
Nov.						
Dec.						

PRIORITY NO. 2 

	Intercept	Independent Variables			R=Coeff. of Corr.	Se=Std. Error of Estimate
		Lag 1	B5DF1	B5GG1		
Jan.	-0.0298	0.8716	-0.0070		0.929	0.111
Feb.	-0.0003	0.9029	0.0077		0.883	0.143
Mar.	-0.2729	0.6628	0.3226		0.880	0.114
Apr.	-0.7002	0.6653	0.8573		0.751	0.205
May	0.3574		-1.0954	1.5708	0.685	0.259
Jun.	1.3154	0.8108	-0.4253		0.700	0.292
Jul.	2.0032	0.8169	-0.6667		0.703	0.344
Aug.	1.2991	0.6529	-0.3699		0.786	0.247
Sep.	-1.3781	0.7790	0.7013		0.716	0.276
Oct.	0.0038	0.8500	0.0578		0.884	0.176
Nov.	-0.2916	0.8537	0.1384		0.930	0.124
Dec.	-0.1458	0.9139	-0.0327		0.933	0.119

- NOTE:1. Priority 1 was used when hydrometric data was available. For all other months priority 2 was used.
2. Natural Flow for January 1912 was assumed to be equal to the average January flow for the 27 years of recorded flow.
3. Coefficient of Correlation (R) and Standard Error of Estimate (Se) are in logarithmic units.


TABLE B-7 (Cont'd)

NATURAL MONTHLY FLOW EXTENDED TO COVER THE PERIOD
1912-1982 FOR BEAVER RIVER AT COLD LAKE RESERVE

(m³/sec)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	CUBIC-DAHS
1912	4.63	4.00	4.30	34.38	33.21	24.82	14.20	9.73	15.43	14.04	9.09	4.73	14.36	454253.0
1913	3.60	3.19	3.69	50.92	46.72	31.63	23.60	15.47	17.80	15.44	9.46	4.98	18.91	596373.2
1914	3.77	3.31	3.62	21.04	57.76	34.23	27.41	20.62	17.13	14.95	9.26	4.88	18.26	575922.4
1915	3.70	3.26	4.06	24.92	23.18	13.57	7.47	6.68	9.84	9.45	6.43	3.45	9.68	305174.0
1916	2.74	2.48	3.44	30.47	44.99	27.51	17.12	12.00	21.68	18.80	12.15	6.09	16.63	525876.2
1917	4.47	3.88	4.23	35.96	54.84	32.46	24.80	18.14	18.75	16.19	10.50	5.39	19.22	606038.2
1918	4.02	3.52	4.46	49.98	34.71	25.05	22.84	16.74	17.46	15.30	9.52	4.96	17.41	548904.9
1919	3.76	3.30	3.32	21.04	23.12	24.56	28.21	16.89	21.31	17.79	10.15	5.30	15.11	476576.2
1920	3.98	3.48	3.77	20.98	30.17	52.89	32.73	20.84	17.29	14.82	8.98	4.76	22.09	698634.4
1921	3.63	3.20	3.54	39.11	55.90	41.01	36.33	23.29	14.96	12.54	7.42	4.00	20.47	645530.4
1922	3.12	2.79	2.99	15.61	46.33	35.50	33.72	20.30	20.79	17.51	10.11	5.35	17.94	565716.4
1923	4.03	3.52	3.47	20.06	30.29	17.64	13.54	10.62	14.50	13.05	6.31	4.33	11.98	377815.0
1924	3.34	2.97	3.33	14.61	34.12	27.95	24.79	16.38	18.83	16.19	9.62	5.04	14.80	467856.2
1925	3.81	3.35	3.49	70.31	38.32	27.18	23.24	13.31	23.76	20.58	12.43	6.22	20.50	646427.5
1926	4.57	3.95	4.72	48.47	33.96	24.75	26.53	19.98	45.81	36.17	21.40	10.42	23.75	749120.0
1927	7.16	5.93	6.46	63.67	95.44	51.91	29.81	18.01	23.16	19.78	11.80	5.99	29.99	945626.6
1928	4.40	3.84	5.94	47.49	17.53	21.50	12.83	11.25	12.13	11.06	7.07	3.78	14.85	469597.4
1929	2.96	2.67	3.26	15.85	25.56	21.04	28.07	21.23	18.19	15.44	9.03	4.78	14.07	443864.1
1930	3.63	3.20	3.90	30.44	26.32	21.83	21.49	16.87	16.68	14.62	6.76	4.60	14.42	454592.5
1931	3.52	3.11	3.31	16.78	21.03	19.16	16.06	13.72	15.04	13.35	6.32	4.35	11.51	363024.1
1932	3.34	2.96	3.19	32.70	52.60	29.32	27.71	18.63	19.63	16.13	10.01	5.20	18.54	586270.8
1933	3.91	3.43	3.72	33.22	62.35	46.36	37.18	27.05	16.55	14.23	8.35	4.45	23.53	742131.7
1934	3.61	3.03	4.33	40.60	41.27	28.69	45.90	22.87	11.55	11.95	7.39	3.94	18.84	594056.6
1935	3.08	2.76	3.02	31.63	79.47	39.72	29.31	61.87	30.72	22.62	13.82	7.01	27.22	858533.4
1936	5.08	4.34	3.97	73.95	90.98	37.49	20.44	9.95	10.49	13.63	8.17	4.38	23.55	744567.1
1937	3.39	3.00	3.12	15.42	19.73	9.89	7.17	6.49	7.11	5.45	4.04	2.26	7.27	229249.9
1938	1.89	1.77	2.36	14.48	18.09	6.77	3.04	2.27	2.07	1.66	1.41	0.67	4.73	149190.9
1939	0.82	0.84	1.72	14.94	23.45	14.38	14.03	5.89	2.68	2.62	2.14	1.27	7.09	23719.1
1940	3.15	1.13	1.71	32.58	11.18	10.12	7.66	5.18	3.60	2.62	1.60	0.98	6.56	207560.9
1941	0.91	0.92	1.51	10.17	15.74	18.68	18.44	15.43	13.67	12.27	7.49	4.02	9.82	309672.2
1942	3.13	2.80	2.97	19.72	15.16	13.00	10.31	9.27	13.19	12.09	7.67	4.13	9.48	298954.2
1943	2.19	2.86	3.40	63.29	59.79	41.14	30.87	20.66	17.31	14.88	8.65	4.62	22.61	712922.1
1944	3.53	3.13	3.99	23.25	18.35	11.39	9.78	8.55	11.40	10.64	6.93	3.75	9.52	300916.9
1945	2.94	2.65	3.27	15.50	18.19	16.81	18.56	15.75	13.99	12.83	8.19	4.30	11.12	350810.8
1946	3.31	2.95	3.64	30.67	17.52	12.83	13.36	13.12	13.40	11.97	7.04	3.73	11.14	351405.5
1947	2.92	2.64	3.58	46.95	41.32	29.79	24.68	18.81	19.83	17.10	10.87	5.95	18.71	590107.6
1948	4.13	3.61	4.74	47.56	102.27	53.73	39.21	21.05	20.58	17.35	10.21	5.37	27.50	869705.0
1949	4.02	3.52	3.19	29.17	22.77	25.09	24.49	19.05	14.96	13.04	8.05	4.36	14.39	453917.9
1950	3.37	2.99	3.23	22.12	30.27	22.34	16.57	15.38	14.80	12.97	7.60	4.05	13.18	415782.4
1951	3.15	2.82	3.09	21.42	93.15	40.26	28.18	19.94	22.86	19.32	11.89	6.06	19.44	612934.4
1952	4.46	3.87	4.58	70.95	39.03	21.90	16.40	12.87	14.27	12.84	8.02	4.30	17.75	561223.2
1953	3.32	2.96	3.53	21.76	40.31	24.33	19.40	13.76	16.09	14.08	8.85	4.86	14.48	456575.7
1954	3.55	3.15	3.55	19.27	36.64	20.58	16.10	10.02	24.96	21.39	13.67	6.77	15.01	473429.4
1955	4.92	4.23	4.75	47.84	72.16	45.19	35.88	26.08	20.11	10.20	3.33	2.11	23.15	730211.6
1956	2.18	2.65	2.80	77.94	95.28	60.44	111.00	49.80	41.10	41.00	23.00	9.30	43.18	1365416.0
1957	4.76	2.94	3.09	30.34	39.88	18.24	15.00	12.70	11.30	18.10	13.10	6.95	14.76	465407.7
1958	5.75	5.07	4.95	86.74	52.58	20.04	7.73	3.50	7.39	10.60	5.92	2.03	17.66	556939.1
1959	1.29	1.11	2.25	17.24	14.18	16.34	26.90	11.80	42.20	33.80	23.10	7.14	16.48	519757.0
1960	3.93	0.91	1.87	37.14	67.78	79.04	71.40	97.00	77.80	40.70	25.50	15.50	43.32	1369822.0
1961	10.20	7.04	8.26	43.34	79.58	32.04	24.50	32.30	7.49	4.18	4.92	2.01	21.43	675890.2
1962	1.80	1.94	2.35	36.54	70.08	284.14	145.00	87.00	37.70	28.50	23.30	10.40	60.83	1918408.0
1963	7.07	5.52	5.53	115.14	112.18	44.64	20.00	9.81	7.45	5.89	2.48	1.42	28.12	886880.1
1964	0.89	0.60	1.70	15.34	32.28	12.44	6.10	10.50	21.90	20.20	9.24	3.50	11.24	355564.9
1965	3.88	3.37	2.69	26.69	85.25	118.19	53.80	15.50	29.70	18.40	11.20	7.44	31.41	990436.9
1966	3.25	3.59	4.90	48.39	34.95	46.69	20.40	16.90	26.00	10.40	7.55	4.42	18.93	597120.8
1967	4.56	4.07	3.75	17.46	72.94	23.86	10.30	10.60	3.93	3.43	3.90	1.64	13.46	424423.1
1968	1.30	1.80	3.81	12.58	8.25	6.57	4.03	4.25	11.60	24.20	10.60	3.20	7.69	243035.9
1969	1.94	1.86	3.79	80.69	61.18	25.50	11.90	13.80	14.80	24.50	11.30	6.97	21.55	679747.2
1970	4.01	3.16	3.70	53.64	41.33	22.14	164.00	71.10	63.50	53.70	34.10	17.60	44.68	1409049.0
1971	11.80	9.80	9.69	112.34	100.43	57.54	137.00	47.70	18.20	11.80	8.13	5.25	44.37	1399183.0
1972	3.59	3.72	4.38	40.74	77.43	20.54	9.72	7.57	5.02	7.00	4.43	2.19	15.57	492294.0
1973	2.54	3.59	2.51	15.75	21.85	53.75	39.40	50.30	54.50	46.10	27.10	17.80	28.02	883750.1
1974	10.90	8.91	8.67	154.35	248.45	81.35	45.10	23.90	21.80	19.80	12.30	7.81	53.83	1697464.0
1975	6.20	6.46	6.00	42.35	83.15	58.85	82.80	39.00	36.10	19.40	11.30	8.02	33.48	1055818.0
1976	7.90	6.89	6.05	36.45	17.95	18.35	65.10	28.50	26.70	13.40	6.62	3.76	19.85	627734.1
1977	4.72	4.70	4.33	21.67	33.87	25.87	15.30	20.70	14.30	22.10	10.20	4.86	15.27	481665.4
1978	4.99	4.99	5.49	33.49	40.94	86.19	20.30	9.79	32.70	29.90	11.20	7.35	23.91	754169.6
1979	5.82	5.13	8.19	40.89	82.24	68.59	41.40	19.60	18.30	13.70	8.14	4.53	26.47	834733.6
1980	3.80	3.03	3.05	33.09	13.14	7.90	4.64	29.40	31.80	27.70	11.70	5.99	14.60	461552.1
1981	4.50	4.78	9.54	25.01	16.16	9.49	23.70	9.25	3.66	2.98	2.70	2.16	9.53	300395.2
1982	1.50	1.40	1.59	12.91	26.66	11.71	10.30	7.03	4.72	3.47	2.27	1.90	7.16	225816.5
MIN	0.82	0.60	1.53	10.17	8.25	6.57	3.04	2.27	2.07	1.66	1.41	0.87	4.73	149190.9
MAX	11.80	9.80	9.69	154.35	248.45	284.14	164.00	97.00	77.80	53.70	34.10	17.80	60.83	1918408.0
MEAN	3.96	3.47	3.99	38.58	48.95	35.33	30.54	20.60	19.83	16.70	10.01	5.25	19.82	625533.9

NOTE: Shaded area denotes natural flow data derived by regression analysis.

Priority 1 


Priority 2 

TABLE B-8

NATURAL MONTHLY FLOW EXTENDED TO COVER THE PERIOD
1912-1982 FOR BEAVER RIVER AT THE ALBERTA-SASKATCHEWAN

(m³/sec)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	CUBIC-DAMS
1912	4.79	4.13	4.44	35.55	34.34	25.67	14.68	10.06	15.95	14.52	9.40	4.89	14.85	469698.0
1913	3.73	3.30	3.82	52.65	48.31	32.71	24.40	16.00	18.40	15.96	9.78	5.15	19.55	616649.9
1914	3.90	3.43	3.74	21.76	59.72	35.40	28.34	21.32	17.71	15.46	9.57	5.05	18.88	595504.2
1915	3.83	3.37	4.20	25.76	23.97	14.03	7.73	6.91	10.17	9.77	6.65	3.57	10.01	315549.9
1916	2.83	2.57	3.56	31.51	46.52	28.44	17.70	12.41	22.42	19.43	12.57	6.30	17.20	543755.6
1917	4.63	4.01	4.37	37.18	56.70	33.56	25.64	18.75	19.39	16.94	10.85	5.57	19.87	626643.6
1918	4.16	3.64	4.61	51.68	35.89	25.90	23.62	17.31	18.06	15.82	9.85	5.13	18.00	567568.2
1919	3.89	3.42	3.43	21.75	23.91	25.39	29.17	19.53	22.03	18.39	10.49	5.48	15.63	492780.3
1920	4.12	3.60	3.90	21.28	82.89	54.69	33.82	21.55	17.88	15.33	9.29	4.92	22.84	722387.6
1921	3.75	3.31	3.66	40.44	57.80	42.41	37.56	24.08	15.05	13.07	7.67	4.13	21.17	667479.1
1922	3.23	2.88	3.10	16.15	47.91	36.71	34.87	20.99	21.49	18.11	10.45	5.53	18.55	584950.9
1923	4.17	3.64	3.59	20.74	31.32	18.24	14.01	10.98	14.99	13.49	8.59	4.47	12.39	390660.6
1924	3.45	3.07	3.44	15.10	35.28	28.90	25.63	16.94	19.47	16.74	9.95	5.21	15.30	483764.0
1925	3.94	3.46	3.61	72.70	39.62	28.11	24.03	13.76	24.57	21.28	12.85	6.43	21.20	668406.2
1926	4.72	4.08	4.88	50.12	35.12	29.73	27.43	20.66	47.36	37.40	22.13	10.78	24.56	774590.4
1927	7.41	6.13	6.68	86.52	98.69	53.68	30.83	18.62	23.95	20.45	12.21	6.19	31.01	977778.2
1928	4.55	3.97	5.73	49.10	38.81	22.24	13.27	11.63	12.54	11.43	7.31	3.90	15.36	485563.2
1929	3.06	2.76	3.37	16.39	26.43	21.75	29.03	21.95	18.80	15.96	9.33	4.92	14.55	458955.7
1930	3.75	3.31	4.03	31.48	27.21	22.57	22.22	17.44	17.45	15.12	9.06	4.75	14.91	470048.7
1931	3.64	3.22	3.42	17.35	21.75	19.81	16.61	14.19	15.55	13.81	8.60	4.49	11.90	375366.7
1932	3.46	3.08	3.30	33.81	54.39	30.32	28.65	19.26	20.29	17.29	10.36	5.38	19.17	606203.9
1933	4.04	3.54	3.84	34.35	85.15	47.94	38.45	27.97	17.11	14.71	8.63	4.60	24.33	767364.2
1934	3.53	3.14	4.47	41.98	42.68	29.66	47.46	23.65	11.95	12.35	7.64	4.07	19.48	614255.0
1935	3.19	2.85	3.12	32.71	82.17	41.07	30.31	63.46	31.77	23.39	14.29	7.25	28.15	887724.1
1936	5.25	4.49	4.11	76.47	94.07	38.76	21.13	10.28	10.85	13.67	8.45	4.53	24.35	769883.0
1937	3.51	3.10	3.22	15.94	20.40	10.23	7.41	6.71	7.35	5.64	4.18	2.33	7.52	237044.5
1938	1.95	1.83	2.44	14.98	18.71	7.00	3.14	2.35	2.14	1.72	1.46	0.90	4.89	154263.4
1939	0.85	0.87	1.78	15.45	24.25	14.78	14.51	6.09	2.77	2.71	2.22	1.31	7.34	231325.6
1940	1.19	1.17	1.77	33.69	11.56	10.46	8.13	5.35	3.73	2.09	1.66	1.01	6.79	214618.0
1941	0.94	0.95	1.58	10.52	16.27	17.24	19.06	15.95	14.14	12.69	7.75	4.15	10.15	320201.2
1942	3.23	2.89	3.07	20.39	15.67	13.44	10.66	9.58	13.64	12.50	8.14	4.27	9.80	309118.7
1943	3.30	2.95	3.52	65.44	61.82	42.54	31.92	21.36	17.90	15.39	8.94	4.77	23.38	707160.7
1944	3.65	3.23	3.71	24.04	18.97	11.78	10.11	8.84	11.78	11.00	7.16	3.87	9.84	311148.2
1945	3.04	2.74	3.39	16.03	18.81	17.39	19.19	16.29	14.47	13.27	8.47	4.44	11.50	362738.2
1946	3.42	3.05	3.76	31.71	18.11	13.27	13.82	13.57	13.86	12.38	7.28	3.86	11.52	363353.1
1947	3.02	2.73	3.70	48.54	42.73	30.80	25.52	19.45	20.50	17.68	11.24	5.74	19.35	610171.2
1948	4.27	3.73	4.28	49.18	105.74	55.56	40.54	21.76	21.28	17.94	10.56	5.55	28.44	899275.4
1949	4.16	3.64	3.92	30.16	23.54	25.94	25.33	19.69	15.47	13.48	8.32	4.51	14.88	469351.4
1950	3.48	3.09	3.34	22.87	31.30	23.10	19.20	15.90	15.30	13.41	7.86	4.19	13.63	429919.2
1951	3.26	2.91	3.19	22.15	54.95	41.63	29.14	20.62	23.64	19.98	12.39	6.27	20.10	633773.9
1952	4.61	4.00	4.74	73.36	40.36	22.65	16.96	13.31	14.75	13.28	8.29	4.45	18.35	580304.5
1953	3.43	3.06	3.65	22.50	41.68	25.16	20.06	14.23	16.64	14.56	9.15	4.82	14.97	472099.7
1954	3.67	3.26	3.67	19.92	37.88	21.28	16.65	10.36	25.80	22.08	14.13	7.00	15.52	489526.5
1955	5.08	4.38	4.91	49.47	74.62	46.72	37.10	26.97	20.79	10.55	3.44	2.18	23.94	755039.4
1956	2.25	2.74	2.90	80.59	98.52	62.50	114.77	51.49	42.50	42.39	23.78	9.62	44.65	1411841.0
1957	4.92	3.04	3.20	31.37	41.24	18.86	15.51	13.13	11.68	18.72	13.55	7.19	15.26	481231.4
1958	5.95	5.24	5.12	89.69	54.37	20.72	7.99	3.62	7.64	10.96	6.12	2.10	18.26	575874.8
1959	1.33	1.15	2.33	17.83	14.66	16.90	27.81	12.20	43.63	34.95	23.89	7.38	17.04	537427.8
1960	4.06	0.94	1.93	38.40	70.09	81.73	73.83	100.30	80.45	42.08	26.37	16.03	44.79	1416397.0
1961	10.55	7.28	8.54	44.81	82.29	33.13	25.33	33.40	7.74	4.32	5.09	2.08	22.16	698870.9
1962	1.86	2.01	2.43	37.78	72.46	293.80	149.93	89.96	38.98	29.47	24.09	10.75	62.90	1983634.0
1963	7.31	5.71	5.72	119.06	116.00	46.16	20.68	10.14	7.70	6.09	2.56	1.47	29.08	917034.0
1964	0.92	0.62	1.76	15.86	33.38	12.86	6.31	10.86	22.64	20.89	9.55	3.62	11.63	367654.2
1965	4.01	3.48	2.78	27.60	88.14	122.21	55.63	16.03	30.71	19.03	11.58	7.69	32.47	1024112.6
1966	3.36	3.71	5.07	50.04	36.13	48.28	21.09	17.47	26.88	10.75	7.81	4.57	19.58	617422.1
1967	4.72	4.21	3.88	18.06	75.42	24.67	10.65	10.96	4.06	3.55	4.03	1.70	13.92	438853.2
1968	1.34	1.86	3.94	13.01	8.53	6.79	4.17	4.39	11.99	25.02	10.96	3.31	7.95	251299.2
1969	2.01	1.92	3.92	83.44	63.26	26.36	12.31	14.27	15.31	25.33	11.69	7.21	22.29	702858.9
1970	4.15	3.27	3.82	55.46	42.74	22.89	169.58	73.52	65.66	55.53	35.26	18.20	46.20	1456957.0
1971	12.20	10.13	10.02	116.15	103.85	59.49	141.66	49.32	18.82	12.20	8.41	5.43	45.88	1446756.0
1972	3.71	3.85	4.53	42.12	80.07	21.23	10.05	7.83	5.19	7.24	4.58	2.26	16.10	509031.9
1973	2.63	3.71	2.60	16.28	22.59	55.57	40.74	52.01	56.35	47.67	28.02	18.41	28.98	913798.0
1974	11.27	9.21	8.96	159.59	256.89	84.11	46.63	24.71	22.54	20.47	12.72	8.08	55.66	1755177.0
1975	6.41	6.68	6.20	43.78	85.97	60.85	85.62	40.33	37.33	20.06	11.68	8.29	34.62	1091715.0
1976	8.17	7.12	6.26	37.68	18.56	18.97	67.31	29.47	27.61	13.86	6.85	3.89	20.53	649077.2
1977	4.88	4.86	4.48	22.40	35.02	26.74	15.82	21.40	14.79	22.85	10.55	5.03	15.79	498042.6
1978	5.16	5.16	5.68	34.63	42.33	89.12	20.99	10.12	33.81	30.92	11.58	7.60	24.73	779812.2
1979	6.02	5.30	8.47	42.28	85.03	70.93	42.81	20.27	18.92	14.17	8.42	4.68	27.37	863114.0
1980	3.93	3.13	3.15	34.22	13.58	8.17	4.80	30.40	32.88	28.64	12.10	6.19	15.09	477245.2
1981	4.65	4.94	9.86	25.86	16.71	9.82	24.51	9.56	3.78	3.08	2.79	2.23	9.85	310608.7
1982	1.55	1.45	1.64	13.35	27.57	12.11	10.65	7.27	4.88	3.59	2.35	1.96	7.40	233494.4
MIN	0.85	0.62	1.58	10.52	8.53	6.79	3.14	2.35	2.14	1.72	1.46	0.90	4.89	154263.4
MAX	12.20	10.13	10.02	159.59	256.89	293.80	169.58	100.30	80.45	55.53	35.26	18.41	62.90	1983634.0
MEAN	4.09	3.58	4.13	39.89	50.61	36.53	31.58	21.30	20.50	17.27	10.35	5.43	20.50	646802.7

TABLE B-9

**ONE-HALF OF NATURAL MONTHLY FLOW EXTENDED, MINUS ALBERTA
WATER USES AT THEIR PRESENT LEVEL OF DEVELOPMENT**

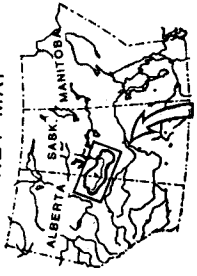
(m³/sec)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	CUBIC-DAMS
1912	2.39	2.07	2.22	17.26	16.51	12.32	7.34	5.03	7.98	7.26	4.70	2.45	7.29	230422.9
1913	1.86	1.65	1.91	25.81	23.49	15.84	12.20	8.00	9.20	7.98	4.89	2.58	9.64	303899.3
1914	1.95	1.71	1.87	10.37	29.20	17.19	14.17	10.66	8.86	7.73	4.79	2.52	9.30	293326.1
1915	1.92	1.69	2.10	12.37	11.32	6.50	3.86	3.45	5.09	4.89	3.33	1.78	4.86	153348.7
1916	1.42	1.28	1.78	15.24	22.60	13.71	8.85	6.20	11.21	9.72	6.28	3.15	8.46	267451.9
1917	2.31	2.00	2.19	18.08	27.69	16.27	12.82	9.38	9.69	8.47	5.43	2.78	9.80	308896.0
1918	2.08	1.82	2.30	25.33	17.29	12.44	11.81	8.66	9.03	7.91	4.92	2.57	8.86	279358.0
1919	1.94	1.71	1.72	10.36	11.29	12.18	14.59	9.77	11.02	9.20	5.25	2.74	7.67	241964.1
1920	2.06	1.80	1.95	10.13	40.79	26.83	16.91	10.77	8.94	7.66	4.64	2.46	11.28	356767.8
1921	1.87	1.66	1.83	19.71	28.24	20.69	18.78	12.04	7.52	6.54	3.84	2.07	10.44	329313.6
1922	1.61	1.44	1.55	7.56	23.29	17.84	17.43	10.50	10.75	9.05	5.23	2.77	9.13	288049.6
1923	2.08	1.82	1.80	9.86	15.00	8.61	7.00	5.49	7.49	6.74	4.30	2.24	6.05	190904.3
1924	1.73	1.54	1.72	7.04	16.98	13.94	12.82	8.47	9.73	8.37	4.97	2.61	7.51	237455.8
1925	1.97	1.73	1.80	35.84	19.15	13.54	12.01	6.88	12.28	10.64	6.43	3.21	10.46	329777.3
1926	2.36	2.04	2.44	24.55	16.90	14.35	13.71	10.33	23.68	18.70	11.06	5.39	12.14	382869.1
1927	3.70	3.07	3.34	42.75	48.68	26.33	15.41	9.31	11.98	10.22	6.10	3.10	15.36	484462.6
1928	2.28	1.98	2.87	24.04	18.74	10.61	6.63	5.82	6.27	5.72	3.66	1.95	7.54	238355.7
1929	1.53	1.38	1.68	7.68	12.55	10.36	14.51	10.97	9.40	7.98	4.67	2.46	7.14	225051.9
1930	1.88	1.66	2.02	15.23	12.95	10.78	11.11	8.72	8.73	7.56	4.53	2.38	7.31	230598.4
1931	1.82	1.61	1.71	8.16	10.21	9.39	8.30	7.10	7.77	6.90	4.30	2.25	5.81	183257.2
1932	1.73	1.54	1.65	16.39	26.53	14.65	14.33	9.63	10.15	8.65	5.18	2.69	9.45	298676.2
1933	2.02	1.77	1.92	16.66	41.91	23.46	19.22	13.99	8.56	7.36	4.32	2.60	12.03	379255.7
1934	1.76	1.57	2.24	20.48	20.68	14.32	23.73	11.82	5.97	6.18	3.82	2.04	9.60	302701.6
1935	1.59	1.43	1.56	15.84	40.43	20.02	15.15	31.73	15.88	11.70	7.14	3.63	13.93	439435.7
1936	2.63	2.25	2.05	37.72	46.38	18.87	10.57	5.14	5.42	6.84	4.22	2.27	12.03	380515.0
1937	1.75	1.55	1.61	7.46	9.54	4.60	3.71	3.35	3.68	2.82	2.09	1.17	3.62	114096.0
1938	0.98	0.92	1.22	6.98	8.69	2.99	1.57	1.17	1.07	0.86	0.73	0.45	2.31	72705.4
1939	0.43	0.43	0.89	7.21	11.46	6.88	7.25	3.04	1.38	1.36	1.11	0.66	3.53	111236.6
1940	0.59	0.58	0.89	16.33	5.12	4.72	4.06	2.68	1.86	1.05	0.83	0.50	3.25	102882.7
1941	0.47	0.48	0.79	4.75	7.47	8.11	9.53	7.98	7.07	6.34	3.87	2.08	4.94	155674.4
1942	1.62	1.45	1.53	9.68	7.18	6.21	5.33	4.79	6.82	6.25	4.07	2.13	4.76	150133.1
1943	1.65	1.48	1.76	32.21	30.25	20.76	15.96	10.68	8.95	7.69	4.47	2.39	11.55	364154.7
1944	1.83	1.62	1.86	11.51	8.82	5.38	5.05	4.42	5.89	5.50	3.58	1.94	4.78	151147.8
1945	1.52	1.37	1.69	7.50	8.75	8.18	9.60	8.14	7.23	6.63	4.23	2.22	5.61	176942.9
1946	1.71	1.53	1.88	15.34	8.40	6.12	6.91	6.79	6.93	6.19	3.64	1.93	5.62	177250.4
1947	1.51	1.37	1.85	23.76	20.70	14.89	12.76	9.73	10.25	8.84	5.62	2.87	9.53	300659.7
1948	2.14	1.87	2.14	24.08	52.21	27.27	20.27	10.88	10.64	8.97	5.28	2.77	14.08	445211.4
1949	2.08	1.82	1.96	14.57	11.11	12.46	12.66	9.85	7.73	6.74	4.16	2.25	7.30	230249.8
1950	1.74	1.55	1.67	10.92	14.99	11.04	9.60	7.95	7.65	6.71	3.93	2.09	6.68	210533.5
1951	1.63	1.46	1.60	10.56	26.81	20.30	14.57	10.31	11.82	9.99	6.20	3.13	9.91	312461.2
1952	2.31	2.00	2.37	36.17	19.52	10.81	8.48	6.65	7.38	6.64	4.14	2.22	9.04	285726.7
1953	1.71	1.53	1.83	10.74	20.18	12.07	10.03	7.11	8.32	7.28	4.58	2.41	7.34	231623.8
1954	1.84	1.63	1.83	9.45	18.28	10.13	8.32	5.18	12.90	11.04	7.06	3.50	7.62	240337.1
1955	2.54	2.19	2.46	24.22	36.65	22.85	18.55	13.48	10.39	5.27	1.72	1.09	11.83	373093.4
1956	1.13	1.37	1.45	39.78	48.60	30.74	57.39	25.75	21.25	21.20	11.89	4.81	22.18	701493.7
1957	2.46	1.52	1.60	15.17	19.96	8.92	7.76	6.57	5.84	9.36	6.77	3.59	7.49	236189.7
1958	2.97	2.62	2.56	44.33	26.52	9.85	4.00	1.81	3.82	5.48	3.06	1.05	8.99	283511.8
1959	0.67	0.57	1.16	8.40	6.67	7.94	13.91	6.10	21.82	17.47	11.94	3.69	8.38	264288.2
1960	2.03	0.47	0.97	18.69	34.38	40.35	36.91	50.15	40.22	21.04	13.18	8.01	22.26	703771.8
1961	5.27	3.64	4.27	21.89	40.48	16.05	12.67	16.70	3.87	2.16	2.54	1.04	10.94	345009.4
1962	0.93	1.00	1.21	18.38	35.57	146.39	74.97	44.98	19.49	14.73	12.05	5.38	31.31	987390.6
1963	3.66	2.85	2.86	59.02	57.34	22.57	10.34	5.07	3.85	3.05	1.28	0.73	14.40	454090.3
1964	0.46	0.31	0.88	7.42	16.03	5.92	3.15	5.43	11.32	10.44	4.78	1.81	5.67	179400.9
1965	2.01	1.74	1.39	13.29	43.41	60.59	27.81	8.01	15.35	9.51	5.79	3.85	16.10	507629.3
1966	1.68	1.86	2.53	24.51	17.41	23.63	10.55	8.74	13.44	5.38	3.90	2.29	9.65	304285.3
1967	2.36	2.10	1.94	8.52	37.05	11.82	5.33	5.48	2.03	1.77	2.02	0.85	6.82	215000.9
1968	0.67	0.93	1.97	5.99	3.60	2.88	2.08	2.20	6.00	12.51	5.48	1.65	3.83	121223.3
1969	1.00	0.96	1.96	41.21	30.97	12.67	6.15	7.14	7.65	12.67	5.84	3.60	11.00	347003.7
1970	2.08	1.64	1.91	27.22	20.71	10.93	84.79	36.76	32.83	27.76	17.63	9.10	22.96	724052.2
1971	6.10	5.07	5.01	57.57	51.26	29.23	70.83	24.66	9.41	6.10	4.20	2.71	22.80	718951.5
1972	1.86	1.92	2.26	20.55	39.37	10.10	5.03	3.91	2.60	3.62	2.29	1.13	7.91	250090.3
1973	1.31	1.86	1.30	7.63	10.63	27.27	20.37	26.01	28.18	23.83	14.01	9.20	14.35	452472.4
1974	5.64	4.61	4.48	79.28	127.79	41.54	23.32	12.36	11.27	10.24	6.36	4.04	27.69	873161.7
1975	3.21	3.34	3.10	21.38	42.33	29.91	42.81	20.16	18.66	10.03	5.84	4.15	17.17	541431.6
1976	4.08	3.56	3.13	18.33	8.62	8.97	33.66	14.73	13.80	6.93	3.42	1.94	10.12	320112.7
1977	2.44	2.43	2.24	10.69	16.85	12.86	7.91	10.70	7.39	11.43	5.27	2.51	7.76	244595.3
1978	2.58	2.58	2.84	16.80	20.50	44.05	10.50	5.06	16.91	15.46	5.79	3.80	12.22	385479.9
1979	3.01	2.65	4.23	20.63	41.86	34.95	21.40	10.13	9.46	7.08	4.21	2.34	13.54	427130.5
1980	1.96	1.57	1.58	16.60	6.13	3.57	2.40	15.20	16.44	14.32	6.05	3.10	7.41	234196.4
1981	2.33	2.47	4.93	12.42	7.69	4.40	12.25	4.78	1.89	1.54	1.40	1.12	4.78	150878.1
1982	0.78	0.72	0.82	6.16	13.12	5.54	5.33	3.63	2.44	1.79	1.17	0.98	3.56	112320.9
MIN	0.43	0.31	0.79	4.75	3.60	2.88	1.57	1.17	1.07	0.86	0.73	0.45	2.31	72705.4
MAX	6.10	5.07	5.01	79.28	127.79	146.39	84.79	50.15	40.22	27.76	17.63	9.20	31.31	987390.6
MEAN	2.05	1.79	2.07	19.43	24.64	17.75	15.79	10.65	10.25	8.63	5.18	2.71	10.11	318975.5

DRAINAGE AREAS OF HYDROMETRIC STATIONS IN
THE BEAVER RIVER DRAINAGE BASIN

HYDROMETRIC GAUGING STATIONS		GROSS (Km ²)	EFFECTIVE (Km ²)
06AA001	Beaver River Near Goodridge	4 714.8	3 780.3
06AA002	Amisk River at Highway No. 36	2 507.4	1 892.0
06AA003	Beaver Lake at Ranger Station	330.7	271.9
06AA901	Columbine Creek near Glendon	241.4	229.2
06AB001	Sand River near the mouth	4 912.4	4 730.6
06AB002	Wolf River at outlet of Wolf Lake	724.9	564.4
06AB003	Punk Creek near the mouth	394.7	384.4
06AC001	Jackfish Creek near LaCorey	494.9	339.3
06AC002	Moore Lake near Cold Lake	42.2	40.9
06AC003	Hilda Lake near Cold Lake	79.8	74.3
06AC004	Ethel Lake near Cold Lake	594.1	583.0
06AC005	Marie Lake near Cold Lake	475.8	475.8
06AC006	Mooselake River near Franchere	1 014.5	644.9
06AC007	Muriel Lake at Gurneyville	463.6	463.6
06AC009	Mantokan Creek near Iron River	442.4	352.8
06AD001	Beaver River Near Dorintosh	20 523.3	16 916.0
06AD006	Beaver River at Cold Lake Reserve	14 526.2	11 602.1
06AD007	Makwa River at Rapid View	2 744.9	2 531.5
06AD009	Makwa River at Outlet of Makwa Lake	1 418.0	1 297.1
06AD010	Meadow River below Meadow Lake	3 341.3	3 101.0
06AD011	Alcott Creek above Meadow Lake	416.2	416.2
06AD012	Chitek Lake at Chitek Village	871.3	700.3
06AD013	Reita Creek near outlet of Angling Lake	161.4	161.4
06AE001	Norbury Creek Near Spiritwood	431.8	169.9
06AE002	Cowan Lake near Honeymoon Point	4 068.1	2 681.9
06AF002	Cold Lake at Cold Lake	6 511.0	6 448.3
06AF005	Waterhen River near Goodsoil	7 757.0	7 639.9
06AF006	Waterhen River above Beaver River	11 142.6	10 946.1
06AF007	Waterhen Lake near Dorintosh	10 186.4	10 044.7
06AF008	Martineau River above Cold Lake	5 351.7	5 338.7
06AG001	Beaver River Below Waterhen River	44 952.6	38 569.8

KEY MAP



— BEAVER RIVER DRAINAGE BASIN

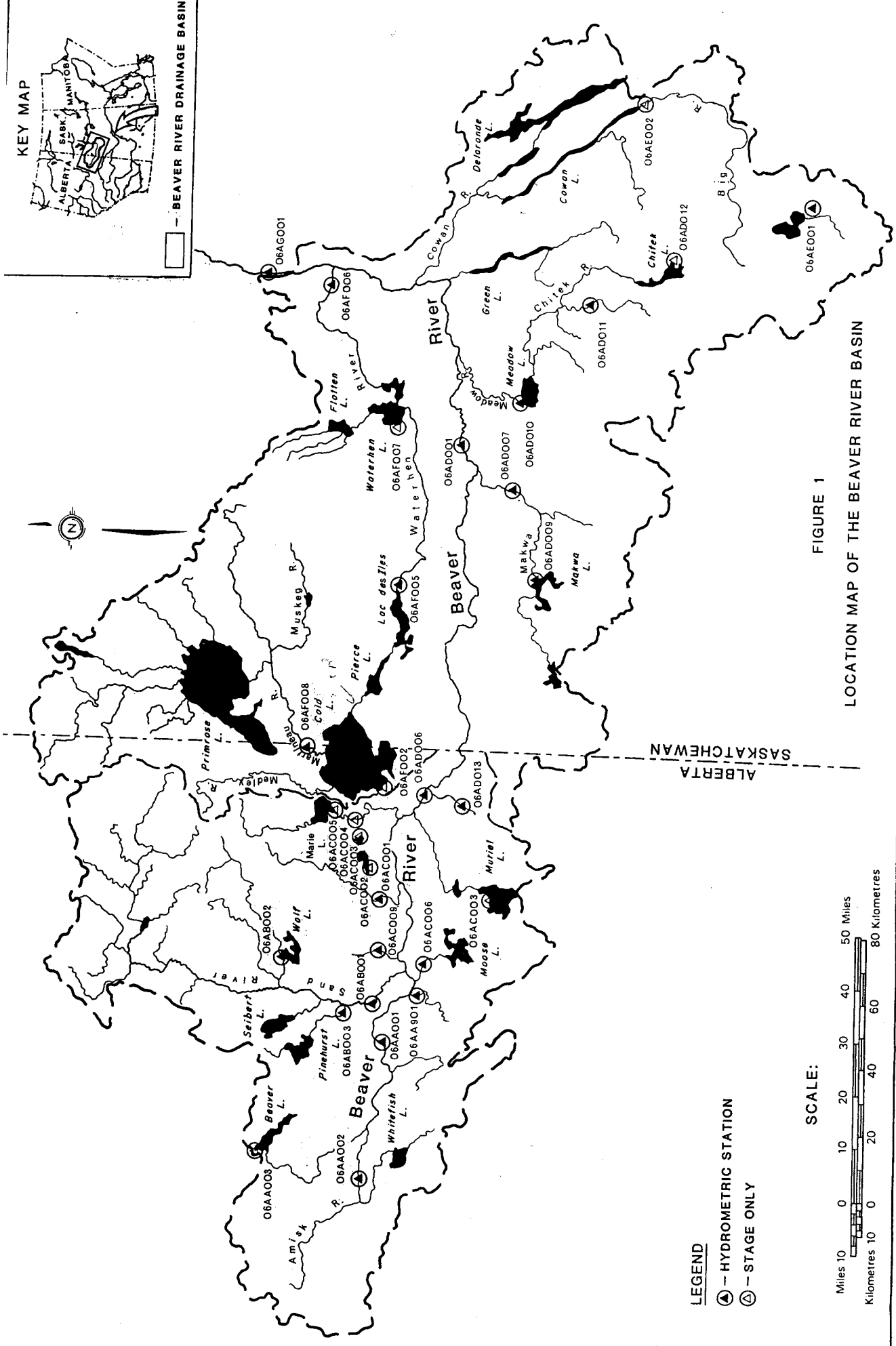
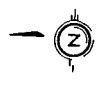


FIGURE 1

LOCATION MAP OF THE BEAVER RIVER BASIN

LEGEND

- ▲ — HYDROMETRIC STATION
- ⊙ — STAGE ONLY

SCALE:

