Report to

THE INTERNATIONAL JOINT COMMISSION

on

THE DIVISION OF THE WATERS OF THE

ST. MARY AND MILK RIVERS

1986

by

D.A. Davis
representing Canada

and

Philip Cohen
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March 1987

International Joint Commission
Ottawa, Ontario and Washington, D.C.

Gentlemen:

In compliance with the provisions of Article VI of the Boundary Waters Treaty of 1909 and Clause VIII (c) of your order of October 4, 1921, directing the division of the waters of the St. Mary and Milk rivers between the United States and Canada, we are transmitting herewith a report on the operations during the irrigation season ended October 31, 1986.

Respectfully submitted,

D.A. Davis
Accredited Officer of Her Majesty

Philip Cohen
Accredited Officer of the United States

SYNOPSIS

During the 1986 irrigation season, the natural flow of the St. Mary and Milk rivers was 82 per cent and 62 per cent, respectively, of the long-term average. All deficits which were incurred on the St. Mary and Milk rivers were satisfactorily refunded.

The natural flow of the St. Mary River at the International Boundary during the irrigation season, April 1 to October 31, 1986, was 589 000 cubic decametres (dam^3) (478,000 acre-feet). Under the terms of the Treaty, the Canadian share was 374 000 dam^3 (303,000 acre-feet). The total flow recorded at the International Boundary during the irrigation season was 120 per cent of the Canadian allotment.

The natural flow of Milk River at the Eastern Crossing of the International Boundary from March 1 to October 31, 1986, was 88 100 dam^3 (71,400 acre-feet). Under the terms of the Treaty, the United States' allotment was 58 800 dam^3 (47,700 acre-feet). Computations indicated that the United States received 152 per cent of its allotment at Eastern Crossing, in addition to the water diverted into the Milk River by the St. Mary Canal.

The March to October natural flow of the three eastern tributaries of the Milk River that are apportioned, Lodge Creek, Battle Creek and Frenchman River, was 277, 237 and 128 per cent, respectively, of the long-term

averages. The combined natural flow of these tribuaries was 276 000 dam^3 (224,000 acre-feet), of which the United States received 199 000 dam^3 (161,000 acre-feet). The totals for Lodge and Battle creeks would have been near normal except for an extremely unusual September rain storm, which resulted in the highest peaks in over 70 years of record on the respective gauges at the International Boundary. This late season runoff accounted for approximately 36 000 dam^3 (29,000 acre-feet), or 90 per cent of the 1986 surplus delivery to the United States on these two tributaries. All deficits which were incurred on the eastern tributaries were satisfactorily refunded.

A late February snowmelt produced significant runoff on Lodge and Battle creeks prior to the traditional March 1 commencement of computations. Although sufficient data was collected to apportion this flow, no precedent had been set, nor provisions agreed upon, to divide flows outside the March to October period. Computations for this pre-March flow indicated a relatively close natural division. Consequently, the Field Representatives mutually agreed to exclude February from the 1986 water division and to develop guidelines for future November to February flows.

TABLE OF CONTENTS

TABLES

TABLE OF CONTENTS (continued)

INTRODUCTION

Article VI of the Boundary Waters Treaty of 1909 between Great Britain and the United States governs the apportionment of the waters of the St. Mary and Milk rivers. The terms of the Treaty were further clarified by the 1921 Order of the International Joint Commission. Copies of Article VI and the 1921 Order are contained in Annex A of this report. To comply with this Treaty, Field Representatives of the United States and Canada collected and compiled hydrometric data at 42 international gauging stations on a co-operative basis. An additional 25 gauging stations were operated independently by Canada or the United States to obtain data on diversions, reservoir contents, return flows and index runoff. Most of this additional information is used to improve the accuracy of natural flow computations.

This report summarizes the natural flow computations of 1986, mentions apportionment of the natural flow, and explains unusual occurrences during the year, as well as procedural modifications designed to increase the accuracy of the natural flow computations. Summary natural flow tables are included. Detailed natural flow computations are included in Appendix A. Daily discharge and other related data are included in Appendix B. Appendices A and B are submitted with this report under separate cover.

In accordance with the International System of Units (SI) conversion schedule established by the International Joint Commission, this report uses SI units first, followed by inch-pound units in parentheses. Data in tables are shown in SI units first, followed by the respective inch-pound units (for example, Tables 1 and 1A).

The format for Appendices A and B of the report is SI units only. All Canadian data are published in SI units. United States data computed in inch-pound units were converted to SI units using the appropriate conversions. A summary of the conversion factors is contained in Annex B.

Mr. D. A. Davis, Director General, Inland Waters and Lands, as Accredited Officer of Her Majesty, was represented in the field by Mr. B. N. Johnson, Acting Regional Chief, Water Resources Branch, Regina, Saskatchewan and Mr. G. H. Morton, Regional Chief, Water Resources Branch, Calgary, Alberta. Mr. Philip Cohen, Chief Hydrologist, United States Geological Survey, as Accredited Officer of the United States, was represented in the field by Mr. J. A. Moreland, District Chief, United States Geological Survey, Helena, Montana. This report was prepared jointly by personnel of the United States Geological Survey and the Environment Canada, Water Resources Branch under the supervision of Messrs. Johnson, Morton and Moreland.

The annual conference of Field Representatives was held in Regina, Saskatchewan on February 4, 1987. Streamflow records collected jointly by Canada and the United States were reviewed and approved. Mutual problems and changes in computational procedures were discussed and a schedule of field operations for 1987 adopted.

ST. MARY RIVER

During the irrigation season, April 1 to October 31, Canada's share of the natural flow of the St. Mary River at the International Boundary, as stipulated by the 1921 Order, is three-fourths of the natural flow when that flow is 666 cubic feet per second (18.86 cubic metres per second) or less. Flows in excess of that quantity are divided equally between Canada and the United States. During the non-irrigation season, November 1 to March 31, the flow is divided equally between the two countries.

To comply with the above order, representatives of both countries make twice-monthly computations of the daily natural flow of the St. Mary River during the irrigation season. If use by the United States is in excess of its share, then at the earliest opportunity a delivery of an equivalent quantity of water is made to Canada. Regular interim reports of these computations are sent to all agencies involved in the water use and management of the flow of the St. Mary River. The interim reports keep these agencies informed as to the quantity of water which was available.

Tentative computations and interim reports are not made during the non-irrigation season when use by the United States is limited to storage in Lake Sherburne. The flow into Lake Sherburne is considerably less than 50 per cent of the natural flow. Occasionally, water is diverted into the St. Mary Canal during the non-irrigation season, necessitating additional tentative computations.

Lake Sherburne, the only storage reservoir within the St. Mary River basin in the United States, is used to store part of the United States' share of flows for later diversion to the Milk River. This water, which passes through Canada, is used by the United States for irrigation in the eastern Milk River valley.

Storage in Lake Sherburne was 27 200 dam^3 (22,100 acre-feet) on October 31, 1985, and had increased to 66 500 dam^3 (53,900 acre-feet) just prior to the irrigation season on March 31, 1986. Maximum storage was 84 600 dam^3 (68,600 acre-feet) on June 30, 1986, and storage decreased to 36 700 dam^3 (29,800 acre-feet) by the end of the irrigation season on October 31, 1986.

Water was diverted from the St. Mary River into the Milk River via the St. Mary Canal from April 1 to September 6, 1986. The total flow recorded at the gauging station on the St. Mary Canal at St. Mary Crossing was 167 000 dam^3 (135,000 acre-feet). Any seepage from the canal between the point of diversion and the crossing of the St. Mary River is assumed to return to the river and eventually become available to Canada.

The total natural flow of the St. Mary River at the International Boundary from November 1, 1985, to October 31, 1986, was 755 000 dam^3 (612,000 acre-feet) of which 589 000 dam^3 (478,000 acre-feet) occurred during the irrigation season, April 1 to October 31, 1986. For the

irrigation season, Canada's and the United States' shares were 374 000 dam^3 (303,000 acre-feet) and 216 000 dam^3 (175,000 acre-feet), respectively. A total discharge of 450 000 dam^3 (365,000 acre-feet) was recorded at the International Boundary, which was 120 per cent of the Canadian share. The computed natural flow during the irrigation season was 82 per cent of the average of the previous 84 years of record.

Minor deficit deliveries were recorded in 5 of the 14 division periods during the 1986 irrigation season. The deficits which occurred during the April 1 to 15, May 1 to 15, July 1 to 15, August 16 to 31 and the October 1 to 15 division periods were refunded during the succeeding periods.

The division of St. Mary River natural flow is summarized in Tables 1 and 1A, which follow. The detailed computation of the natural flow is given in Table 6 and the historical summary in Table 7 of Appendix A.

TABLE 1

SUMMARY OF DIVISION OF ST. MARY RIVER AND DIVERSION TO MILK RIVER[1]

1986

QUANTITIES IN CUBIC DECAMETRES

	ST. MARY RIVER AT INTERNATIONAL BOUNDARY				EXCESS REC'D. BY CANADA	CHANGE IN STORAGE-LAKE SHERBURNE	TOTAL AVAILABLE FOR DIVERSION	ST. MARY CANAL AT ST. MARY CROSSING	MILK RIVER AT EASTERN CROSSING
	RECORDED FLOW	NATURAL FLOW	U.S. SHARE	CANADA'S SHARE					
APR.	47 229	64 080	19 846	44 234	2 995	- 1 330	21 176	18 181	23 221
MAY	104 636	135 715	55 232	80 483	24 153	9 423	45 809	21 656	40 386
JUN.	150 358	193 094	84 331	108 763	41 595	10 367	73 964	32 369	29 734
JUL.	52 442	78 111	26 450	51 661	781	-21 660	48 110	47 329	42 380
AUG.	28 476	36 018	9 004	27 014	1 462	-36 301	45 305	43 843	36 019
SEP.	30 001	38 286	9 572	28 714	1 287	4 302	5 270	3 983	23 558
OCT.	36 477	44 191	11 539	32 652	3 825	7 714	3 825	0	5 740
TOTAL IRRIGATION SEASON	449 619	589 495	215 974	373 521	76 098	-27 485	243 459	167 361	201 038

QUANTITIES FOR ST. MARY RIVER DIVISION PERIODS, IN CUBIC DECAMETRES

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	CANADA'S SHARE	RECEIVED BY CANADA	RECEIVED BY CANADA	
				ABOVE SHARE	BELOW SHARE
APR 1 TO APR 15	27 023	19 600	19 500		100
APR 16 TO APR 30	37 057	24 634	27 729	3 095	
MAY 1 TO MAY 15	43 419	27 819	27 614		205
MAY 16 TO MAY 31	92 296	52 664	77 022	24 358	
JUN 1 TO JUN 15	128 129	70 172	108 578	38 406	
JUN 16 TO JUN 30	64 965	38 591	41 780	3 189	
JUL 1 TO JUL 15	45 702	28 961	28 765		196
JUL 16 TO JUL 31	32 409	22 700	23 677	977	
AUG 1 TO AUG 15	20 239	15 180	16 723	1 543	
AUG 16 TO AUG 31	15 779	11 834	11 753		81
SEP 1 TO SEP 15	19 067	14 301	15 292	991	
SEP 16 TO SEP 30	19 219	14 413	14 709	296	
OCT 1 TO OCT 15	24 512	17 902	17 825		77
OCT 16 TO OCT 31	19 679	14 750	18 652	3 902	

[1] This is a summary of data from Table 6, Appendix A.

TABLE 1A

SUMMARY OF DIVISION OF ST. MARY RIVER AND DIVERSION TO MILK RIVER[1]

1986

QUANTITIES IN ACRE-FEET

	ST. MARY RIVER AT INTERNATIONAL BOUNDARY				EXCESS REC'D. BY CANADA	CHANGE IN STORAGE-LAKE SHERBURNE	TOTAL AVAILABLE FOR DIVERSION	ST. MARY CANAL AT ST. MARY CROSSING	MILK RIVER AT EASTERN CROSSING
	RECORDED FLOW	NATURAL FLOW	U.S. SHARE	CANADA'S SHARE					
APR.	38,289	51,950	16,089	35,861	2,428	-1,078	17,167	14,739	18,825
MAY	84,829	110,024	44,777	65,248	19,581	7,639	37,137	17,557	32,741
JUN.	121,895	156,542	68,367	88,174	33,721	8,405	59,963	26,242	24,105
JUL.	42,515	63,325	21,443	41,882	633	-17,560	39,003	38,370	34,358
AUG.	23,086	29,200	7,300	21,900	1,185	-29,429	36,729	35,544	29,201
SEP.	24,322	31,039	7,760	23,278	1,043	3,488	4,272	3,229	19,098
OCT.	29,572	35,826	9,355	26,471	3,101	6,254	3,101	0	4,653
TOTAL IRRIGATION SEASON	364,508	477,906	175,090	302,814	61,693	-22,282	197,372	135,681	162,981

QUANTITIES FOR ST. MARY RIVER DIVISION PERIODS, IN ACRE-FEET

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	CANADA'S SHARE	RECEIVED BY CANADA	RECEIVED BY CANADA	
				ABOVE SHARE	BELOW SHARE
APR 1 TO APR 15	21,908	15,890	15,809		81
APR 16 TO APR 30	30,042	19,971	22,480	2,509	
MAY 1 TO MAY 15	35,200	22,553	22,387		166
MAY 16 TO MAY 31	74,824	42,695	62,442	19,747	
JUN 1 TO JUN 15	103,874	56,889	88,024	31,136	
JUN 16 TO JUN 30	52,667	31,286	33,871	2,585	
JUL 1 TO JUL 15	37,051	23,479	23,320		159
JUL 16 TO JUL 31	26,274	18,403	19,195	792	
AUG 1 TO AUG 15	16,408	12,306	13,557	1,251	
AUG 16 TO AUG 31	12,792	9,594	9,528		66
SEP 1 TO SEP 15	15,458	11,594	12,397	803	
SEP 16 TO SEP 30	15,581	11,685	11,925	240	
OCT 1 TO OCT 15	19,872	14,513	14,451		62
OCT 16 TO OCT 31	15,954	11,958	15,121	3,163	

[1] All values are conversions of data from Table 1. Totals and shares may not add or subtract exactly as a result of rounding.

MILK RIVER

During the irrigation season, April 1 to October 31, the United States' share of the natural flow of the Milk River at the Eastern Crossing of International Boundary, as stipulated by the 1921 Order, is three-fourths of the natural flow when that flow is 666 cubic feet per second (18.86 cubic metres per second) or less. Flows in excess of that quantity are divided equally between the United States and Canada. During the non-irrigation season, November 1 to March 31, the entire flow is divided equally between the two countries.

Prior to the mid-seventies, uses of the natural flow of the Milk River by Canada and the United States were assumed to be less than their respective shares and no formal apportionment was made. By 1977, it became apparent that the increasing numbers of sprinkler irrigation systems were capable of using all of the natural flow for long periods of time. Consequently, a more comprehensive natural flow computation and water division procedure was developed and has been used since 1985. This computation includes adjustment for water diverted from the St. Mary River Basin, evapotranspiration losses, and agricultural uses in both countries.

To comply with the 1921 Order, representatives of both countries now make tentative monthly computations of the natural flow of the Milk River during the irrigation season. Additional computations are made when the natural flow is low and irrigation use is high. When Canada uses more

than its share of natural flow for an extended period of time, the Accredited Officers, after Field Representatives' consultation with the appropriate water-use agencies, may agree to make up the deficit on the Milk River by reducing the Canadian share of the St. Mary River by an equal amount. These arrangements are made on an ad hoc basis as the situations arise.

The natural flow of the Milk River at Eastern Crossing of International Boundary from March 1 to October 31, 1986 was 88 100 dam^3 (71,400 acre-feet). This flow was 62 per cent of the average natural flow of the previous 74 years of record. The respective shares of the United States and Canada were 58 800 dam^3 (47,700 acre-feet) and 29 200 dam^3 (23,700 acre-feet). During this period, Canada diverted 6 730 dam^3 (5,460 acre-feet) into the Milk River through Verdigris Coulee. This diversion, combined with the natural flow of the Milk River, resulted in the United States receiving 152 per cent of its allotment.

The division of Milk River natural flow is summarized in Tables 2 and 2A, which follow. The detailed computation of natural flow is given in Table 8 and the historical summary in Table 9 of Appendix A.

TABLE 2

SUMMARY TABLE
NATURAL FLOW AND DELIVERIES OF
MILK RIVER NATURAL FLOW AT EASTERN CROSSING
OF INTERNATIONAL BOUNDARY[1]

1986

QUANTITIES IN CUBIC DECAMETRES

PERIOD	NATURAL FLOW AT EAST CROSSING	SHARE		MILK RIVER AT EAST CROSSING	DIVERSION FROM ST. MARY BASIN	EXCESS(+)/ DEFICIT(-)/ DELIVERY TO U.S.	CUMULATIVE EXCESS(+)/ DEFICIT(-) U.S.
		U.S.	CANADA				
JAN 1 - JAN 31	4 016	2 008	2 008	-	-	+ 2 008	+ 2 008
FEB 1 - FEB 28	42 207	21 104	21 104	-	-	+ 21 104	+ 23 111
MAR 1 - MAR 31	28 176	14 088	14 088	29 217	-	+ 15 129	+ 38 240
APR 1 - APR 30	9 644	7 233	2 411	23 210	12 964	+ 3 360	+ 41 601
MAY 1 - MAY 31	22 109	16 582	5 527	40 392	20 425	+ 5 687	+ 47 288
JUN 1 - JUN 30	8 260	6 195	2 065	29 722	25 299	+ 1 383	+ 48 671
JUL 1 - JUL 31	2 228	1 671	557	42 405	44 277	- 396	+ 48 275
AUG 1 - AUG 31	612	459	153	36 024	40 095	- 332	+ 47 943
SEP 1 - SEP 30	12 266	9 036	3 229	23 552	11 668	+ 3 812	+ 51 755
OCT 1 - OCT 31	4 777	3 583	1 194	5 740	-	+ 2 157	+ 53 912
NOV 1 - NOV 30	2 363	1 182	1 182	-	-	+ 1 233	+ 55 144
DEC 1 - DEC 31	2 295	1 147	1 147	-	-	+ 1 147	+ 56 292
TOTALS	138 952	84 287	54 665	230 262	154 728	+ 56 292	+ 56 292

[1] This is a summary of data from Table 8, Appendix A.

TABLE 2A

SUMMARY TABLE
NATURAL FLOW AND DELIVERIES OF
MILK RIVER NATURAL FLOW AT EASTERN CROSSING
OF INTERNATIONAL BOUNDARY[1]

1986

QUANTITIES IN ACRE-FEET

PERIOD	NATURAL FLOW AT EAST CROSSING	SHARE		MILK RIVER AT EAST CROSSING	DIVERSION FROM ST. MARY BASIN	EXCESS(+)/ DEFICIT(-)/ DELIVERY TO U.S.	CUMULATIVE EXCESS(+)/ DEFICIT(-) U.S.
		U.S.	CANADA				
JAN 1 - JAN 31	3,255	1,628	1,628	-	-	+ 1,628	+ 1,628
FEB 1 - FEB 28	34,218	17,109	17,109	-	-	+ 17,109	+ 18,737
MAR 1 - MAR 31	22,843	11,421	11,421	23,687	-	+ 12,265	+ 31,002
APR 1 - APR 30	7,819	5,864	1,955	18,816	10,510	+ 2,724	+ 33,726
MAY 1 - MAY 31	17,924	13,443	4,481	32,746	16,559	+ 4,610	+ 38,337
JUN 1 - JUN 30	6,696	5,022	1,674	24,096	20,510	+ 1,121	+ 39,458
JUL 1 - JUL 31	1,807	1,355	452	34,378	35,896	- 321	+ 39,137
AUG 1 - AUG 31	496	372	124	29,206	32,505	- 269	+ 38,868
SEP 1 - SEP 30	9,944	7,326	2,618	19,094	9,459	+ 3,091	+ 41,958
OCT 1 - OCT 31	3,873	2,905	968	4,653	-	+ 1,748	+ 43,707
NOV 1 - NOV 30	1,916	958	958	-	-	+ 999	+ 44,706
DEC 1 - DEC 31	1,860	930	930	-	-	+ 930	+ 45,636
TOTALS	112,650	68,333	44,318	186,676	125,440	+ 45,636	+ 45,636

[1] All values are conversions of data from Table 2. Totals and shares may not add or subtract exactly as a result of rounding.

EASTERN TRIBUTARIES OF THE MILK RIVER

The waters of the eastern tributaries of the Milk River are divided in accordance with the Order of the International Joint Commission, dated October 4, 1921, which stipulates under Rule III that "The natural flow of the eastern (otherwise known as the Saskatchewan or northern) tributaries of the Milk River at the points where they cross the International Boundary shall be divided equally between the two countries." This order might well be interpreted as requiring that the division of water be made on a continuing basis. However, the physical limitation due to transit time in the flow system was recognized. Further analysis showed that the minimum practical time frame for compilation of the natural flows at the International Boundary was every 10 days.

Prior to 1937, Canadian use along the eastern tributaries consisted of domestic irrigation and the Canadian share of the natural flow was not fully used. In the late thirties, the Government of Canada constructed three dams on the Frenchman River creating: Eastend Reservoir (station 11AC055), Huff Lake (station 11AC063), and Newton Lake (station 11AC056), and subsequently an operational division of flow on this tributary became necessary by 1937. To allow interbasin storage and transfers of water, dams were constructed in 1938 at both ends of Cypress Lake (station 11AC037) on the Battle Creek-Frenchman River divide.

The redevelopment of several private irrigation projects and the construction of the Vidora Irrigation Project during the early fifties resulted in increased use of Battle Creek water in Canada and made an operational division of flow on this tributary necessary by 1957.

Construction of Altawan Reservoir (station 11AB089) and the Spangler irrigation project on Lodge Creek in 1960 made an operational division of flow on this tributary necessary by 1961.

During the period March 1 to October 31, ten-day computations of the natural flows of Lodge Creek, Battle Creek and Frenchman River are made to determine each country's share. If use by Canada is in excess of its share, then at the earliest opportunity, a delivery of an equivalent quantity of water is made to the United States. During some years the United States may request that delivery of deficit water on Battle Creek be delayed to allow more efficient use by United States irrigators. Canada may honor this request if no regulation problems are anticipated by delaying the delivery of water to refund the deficit. Regular interim reports on the progress of the division of the natural flows of Lodge Creek, Battle Creek, and Frenchman River at the International Boundary are distributed to interested agencies throughout the irrigation season. Generally, no division of flow is made during the winter, as flow and use are low and streamflow records are impractical to obtain.

Normally, in the eastern tributaries, weather conditions are such that little significant flow occurs prior to March 1 and, as well, field conditions are such that little satisfactory record is obtainable. In

1986 an unusually early spring runoff occurred in the Lodge Creek and Battle Creek basins, resulting in substantial flow prior to March 1. Hydrographers from the Water Survey of Canada, Water Resources Branch, Saskatchewan were in the vicinity to monitor and record flow at key locations in the basins, providing a rare opportunity to calculate natural flow prior to March 1. The resulting computations indicated that Canada had a deficit delivery on the Lodge Creek and a surplus delivery on the Battle Creek. The Field Representatives mutually agreed that because the surplus and deficit were small compared to the natural flows, the early runoff would not be included in the water division. Subsequently, at the 1986 Records Conference, the Field Representatives agreed to prepare guidelines or future November to February flows.

Lyons Creek is monitored but does not have sufficient use in Canada at this time to warrant an operational division of flow. A flow of 9 380 dam^3 (7,600 acre-feet) was recorded on this tributary from March 1 to October 31, 1986.

In 1986, the only change to the network of hydrometric stations in the eastern tributaries was the designation of the stations Middle Creek near Govenlock (11AB108) and Middle Creek above Lodge Creek (11AB008) as international gauging stations. These stations are used to compute the diversion of the Stokke-Buchanan irrigation projects in the Lodge Creek Basin in Saskatchewan. The procedure of computing the diversion of the Stokke-Buchanan projects was revised to make it consistent with similar procedures in the basin.

Water use data for unmeasured diversions to private irrigation projects in the Lodge Creek, Battle Creek, and Frenchman River basins in Saskatchewan were based on year-end reports provided by the Saskatchewan Water Corporation, and in the Lodge Creek and Battle Creek basins in Alberta, by Alberta Environment. These reports are compiled from individual reports received from the operators of individual projects and by onsite inspections. An additional adjustment is made for domestic projects in the Battle Creek and Frenchman River basins, based on the results of studies conducted by Canada on domestic use.

For the interim reports prepared at the end of division periods, Alberta Environment provided reports of minor diversion use for projects in Alberta. For Saskatchewan, estimates of minor diversions were based on a correlation between annual natural flows and reported use for previous years. The total natural flow for the current year was derived from computed natural flow to date, plus an estimate of runoff volume for the rest of the year, dependent on runoff conditions. At mid-year and at year end, estimates of minor diversions were updated based on reports received from Alberta Environment and the Saskatchewan Water Corporation on minor diversion usage in their respective provinces. Consequently, some discrepancy exists between interim and final division computations.

Since 1984 Alberta Environment has provided, in their report of minor diversion usage, dates of when the usage occurred. In 1986, the Saskatchewan Water Corporation also provided dates of usage for most projects. Previously, only a volume of usage in the period March 1 to

October 31 had been provided. The provision of dates of minor diversion usage has improved the natural flow calculations, allowing a more accurate determination of the natural flow in each ten-day division period. Lists of reported diversions for 1986 are contained in Appendix B.

At the end of February the combined usable storage of the six major Canadian reservoirs was 21 900 dam^3 (17,800 acre-feet), or 15 per cent of their total usable storage of 142 200 dam^3 (115,300 acre-feet). By the end of May spring flows had increased the usable storage to a level of 35 per cent of total. Irrigation usage, evaporation, and releases from the reservoirs depleted the usable storage to a level of 17 per cent of the total usable storage by the end of August. Above normal fall precipitation increased the usable storage to 41 000 dam^3 (32,200 acre-feet), or 29 per cent of the total usable storage by the end of October. Further details of the status of available storage in the major Canadian reservoirs during 1986 are provided in Table 16 of Appendix A.

LODGE CREEK

The computed natural flow of Lodge Creek below McRae Creek at International Boundary (station 11AB083) from March 1 to October 31, 1986 was 93 900 dam^3 (76,100 acre-feet) or 277 per cent of the average natural flow of the previous 36 years of record. Each country is entitled to 50 per cent of the natural flow or 46 950 dam^3 (38,060 acre-feet). A total flow of 75 100 dam^3 (60,900 acre-feet) was recorded at the International Boundary from March 1 to October 31.

The majority of flow occurred as a result of an intense rainstorm which occurred in the last week of September. Approximately 150 to 190 mm (6 to 7.5 inches) of rain fell in a twenty-hour period, from the evening of September 24 to the afternoon of September 25. The rainfall covered most of the Lodge Creek drainage basin. In three days, September 25 to 27, a flow of 42 900 dam^3 (34,800 acre-feet) crossed the International Boundary. The peak discharge of 280 m^3/s (9,890 ft^3/s) recorded on September 25 at Lodge Creek below McRae Creek at International Boundary, exceeded the previous historical peak of 220 m^3/s (7,770 ft^3/s) recorded on June 14, 1962. The high flows caused extensive flooding of agri- cultural lands and caused some damage to several irrigation project structures. In particular, several dykes related to the Stokke-Buchanan irrigation projects were washed out. This may result in lower than normal irrigation usage until the structures are repaired.

Deficit deliveries were recorded in 4 of the 24 division periods during the season. All deficits were refunded satisfactorily.

A return flow of 365 dam^3 (296 acre-feet) was recorded at Squaw Coulee near Willow Creek (station 11AB103) from the 3 000 dam^3 (2,430 acre-feet) diverted from Lodge Creek by Spangler Ditch (station 11AB060).

The division of the Lodge Creek natural flow is summarized in Tables 3 and 3A, which follow. The detailed computation of the natural flow is given in Table 10 and the historical summary in Table 11 of Appendix A.

TABLE 3

SUMMARY OF LODGE CREEK DIVISION[1]

1986

QUANTITIES IN CUBIC DECAMETRES

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 10	27 074	13 537	13 853	316	
MAR 11 - MAR 20	2 216	1 108	1 161	53	
MAR 21 - MAR 31	2 132	1 066	1 663	597	
APR 1 - APR 10	507	254	529	275	
APR 11 - APR 20	453	226	189		37
APR 21 - APR 30	132	66	147	81	
MAY 1 - MAY 10	0	0	119	119	
MAY 11 - MAY 20	1 182	591	703	112	
MAY 21 - MAY 31	3 285	1 643	2 520	877	
JUN 1 - JUN 10	225	112	153	41	
JUN 11 - JUN 20	205	103	66		37
JUN 21 - JUN 30	37	18	29	11	
JUL 1 - JUL 10	10	5	2		3
JUL 11 - JUL 20	217	109	182	73	
JUL 21 - JUL 31	0	0	7	7	
AUG 1 - AUG 10	27	13	6		7
AUG 11 - AUG 20	0	0	1	1	
AUG 21 - AUG 31	0	0	0	0	
SEP 1 - SEP 10	0	0	0	0	
SEP 11 - SEP 20	3	2	3	2	
SEP 21 - SEP 30	53 011	26 505	49 763	23 528	
OCT 1 - OCT 10	2 236	1 118	3 019	1 901	
OCT 11 - OCT 20	568	284	595	311	
OCT 21 - OCT 31	347	173	347	173	
TOTAL	93 868	46 934	75 057		

[1] This is a summary of data from Table 10, Appendix A.

TABLE 3A

SUMMARY OF LODGE CREEK DIVISION[1]

1986

QUANTITIES IN ACRE-FEET

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 10	21,949	10,974	11,231	256	
MAR 11 - MAR 20	1,797	898	941	43	
MAR 21 - MAR 31	1,728	864	1,348	484	
APR 1 - APR 10	411	206	429	223	
APR 11 - APR 20	367	183	153		30
APR 21 - APR 30	107	54	119	66	
MAY 1 - MAY 10	0	0	96	96	
MAY 11 - MAY 20	958	479	570	91	
MAY 21 - MAY 31	2,663	1,332	2,043	711	
JUN 1 - JUN 10	182	91	124	33	
JUN 11 - JUN 20	166	84	54		30
JUN 21 - JUN 30	30	15	24	9	
JUL 1 - JUL 10	8	4	2		2
JUL 11 - JUL 20	176	88	148	59	
JUL 21 - JUL 31	0	0	6	6	
AUG 1 - AUG 10	22	11	5		6
AUG 11 - AUG 20	0	0	1	1	
AUG 21 - AUG 31	0	0	0	0	
SEP 1 - SEP 10	0	0	0	0	
SEP 11 - SEP 20	2	2	2	2	
SEP 21 - SEP 30	42,976	21,488	40,343	19,074	
OCT 1 - OCT 10	1,813	906	2,448	1,541	
OCT 11 - OCT 20	460	230	482	252	
OCT 21 - OCT 31	281	140	281	140	
TOTAL	76,099	38,049	60,849		

[1] All values are conversions of data from Table 3. Totals and shares may not add or subtract exactly as a result of rounding.

BATTLE CREEK

The computed natural flow of Battle Creek at the International Boundary (station 11AB027) from March 1 to October 31, 1986, was 75 200 dam^3 (61,000 acre-feet) or 238 per cent of the average natural flow of the previous 46 years of record. Each country is entitled to 50 per cent of the natural flow or 37 600 dam^3 (30,500 acre-feet). A total flow of 49 500 dam^3 (40,100 acre-feet) was recorded at the International Boundary.

The same rainstorm which inundated the Lodge Creek Basin also covered the Battle Creek Basin. In the three days, September 25 to 27, a flow of 19 800 dam^3 (16,100 acre-feet) crossed the International Boundary. The peak discharge of 277 m^3/s (9,780 ft^3/s) recorded on September 25 at Battle Creek at International Boundary exceeded the previous historical peak of 165 m^3/s (5,830 ft^3/s) recorded on April 15, 1952.

Deficit deliveries were recorded in 7 of the 24 division periods during the season. All deficits were satisfactorily refunded.

A return flow of 35 per cent of diversion, based on a 1972-76 study, was used for the Gaff Ditch diversion from Battle Creek. The recorded flow at Gaff Ditch near Merryflat from March 1 to October 31, 1986, was 2 210 dam^3 (1,790 acre-feet) with the return flow computed at 35 per cent, or 774 dam^3 (627 acre-feet). During the irrigation period, the return flow was computed to be 25 per cent for Vidora, Richardson, and McKinnon

ditches. Calculations of return flow for Nashlyn Canal resulted in an unreasonable return flow percentage of 102 per cent. The computations were thrown awry by localized rainstorms, causing higher flows at the downstream return flow measuring station than at the station upstream of the diversion. In addition, project operators held water on their irrigated lands longer than normal and usual lag times were not applicable. Personnel of the Prairie Farm Rehabilitation Administration in Consul, Saskatchewan stated that their field observations indicated that return flow from the Nashlyn project appeared to be normal; therefore, it was decided to use the normal return flow figure of 25 per cent.

A supplementary gauging station has been operated since 1981 on Shepherd Ditch, a private diversion on Battle Creek, located downstream from Gaff Ditch. A total diversion of 1 020 dam^3 (827 acre-feet) was recorded at this station during 1986, and is included in the list of minor diversions for Battle Creek in Appendix B.

No irrigation usage occurred in the Battle Creek Basin after July. However, due to the higher than normal precipitation in September, it was estimated that additional storage in domestic reservoirs occurred during that period. The calculations of natural flow were amended to reflect the additional estimated domestic usage.

The division of the Battle Creek natural flow is summarized in Tables 4 and 4A, which follow. The detailed computation of the natural flow is given in Table 12 and the historical summary in Table 13 of Appendix A.

TABLE 4

SUMMARY OF BATTLE CREEK DIVISION[1]

1986

QUANTITIES IN CUBIC DECAMETRES

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 14	22 634	11 317	11 970	653	
MAR 15 - MAR 25	3 745	1 873	1 154		719
MAR 26 - APR 4	2 165	1 083	1 469	386	
APR 5 - APR 14	1 320	660	723	63	
APR 15 - APR 24	992	496	320		176
APR 25 - May 4	678	339	135		204
MAY 5 - MAY 14	1 269	635	231		404
MAY 15 - MAY 25	2 077	1 039	383		656
MAY 26 - JUN 4	1 529	765	937	172	
JUN 5 - JUN 14	448	224	1 064	840	
JUN 15 - JUN 24	546	273	888	615	
JUN 25 - JUL 4	341	171	356	185	
JUL 5 - JUL 14	297	149	263	114	
JUL 15 - JUL 25	876	438	489	51	
JUL 26 - AUG 4	202	101	202	101	
AUG 5 - AUG 14	121	61	121	60	
AUG 15 - AUG 25	71	36	71	35	
AUG 26 - SEP 4	95	48	45		3
SEP 5 - SEP 14	237	119	137	18	
SEP 15 - SEP 24	695	348	500	152	
SEP 25 - OCT 4	30 001	15 001	25 475	10 474	
OCT 5 - OCT 14	2 976	1 488	1 362		126
OCT 15 - OCT 25	1 281	641	669	28	
OCT 26 - OCT 31	580	290	580	290	
TOTAL	75 176	37 595	49 544		

[1] This a summary of data from Table 12, Appendix A.

TABLE 4A

SUMMARY OF BATTLE CREEK DIVISION[1]

1986

QUANTITIES IN ACRE-FEET

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 14	18,349	9,175	9,704	529	
MAR 15 - MAR 25	3,036	1,518	936		583
MAR 26 - APR 4	1,755	878	1,191	313	
APR 5 - APR 14	1,070	535	586	51	
APR 15 - APR 24	804	402	259		143
APR 25 - MAY 4	550	275	109		165
MAY 5 - MAY 14	1,029	515	187		328
MAY 15 - MAY 25	1,684	842	310		532
MAY 26 - JUN 4	1,240	620	760	139	
JUN 5 - JUN 14	363	182	863	681	
JUN 15 - JUN 24	443	221	720	499	
JUN 25 - JUL 4	276	139	289	150	
JUL 5 - JUL 14	241	121	213	92	
JUL 15 - JUL 25	710	355	396	41	
JUL 26 - AUG 4	164	82	164	82	
AUG 5 - AUG 14	98	49	98	49	
AUG 15 - AUG 25	58	29	58	28	
AUG 26 - SEP 4	77	39	36		2
SEP 5 - SEP 14	192	96	111	15	
SEP 15 - SEP 24	563	282	405	123	
SEP 25 - OCT 4	24,322	12,161	20,653	8,491	
OCT 5 - OCT 14	2,413	1,206	1,104		102
OCT 15 - OCT 25	1,039	520	542	23	
OCT 26 - OCT 31	470	235	470	235	
TOTAL	60,945	30,478	40,165		

[1] All values are conversions of data from Table 4. Totals and shares may not add or subtract exactly as a result of rounding.

FRENCHMAN RIVER

The computed natural flow of the Frenchman River at the International Boundary (station 11AC041) from March 1 to October 31, 1986, was 107 000 dam^3 (86,700 acre-feet) or 128 per cent of the average natural flow of the previous 46 years of record. Each country is entitled to 50 per cent of the natural flow or 53 500 dam^3 (43,400 acre-feet). A total flow of 74 100 dam^3 (60,100 acre-feet) was recorded at Frenchman River at International Boundary.

Deficit deliveries were recorded in 4 of the 24 division periods during the season. Deficits incurred in periods 12 and 13 (June 21 to July 10) and were refunded by period 15 (July 21-31). The other 2 deficit deliveries were incurred in periods 21 and 22 (September 21 to October 10). The latter deficits were a result of storage of natural runoff from the same rainstorm which caused the high flows in the Lodge Creek and Battle Creek basins. However, the rainfall over the Frenchman River Basin was far less intense than that experienced in the other two basins. From September 21 to October 10, a net depletion of 4 064 dam^3 (3,290 acre-feet) from the natural flow at the International Boundary was recorded in the Cypress Lake and Val Marie areas, while a net release of 188 dam^3 (152 acre-feet) was made from Eastend Reservoir. The resultant net depletion in the basin was then 3 876 dam^3 (3,142 acre-feet). Releases were initiated from Newton Lake in period 23 in attempts to make up the deficit by October 31, the last day of the normal division period. However, a deficit of 410 dam^3 (332 acre-feet) remained. The Field Representatives agreed that the deficit should be refunded and, with

storage available in the Frenchman Reservoir in Montana, the waters released from Canada to make up the deficit would be of beneficial use to the United States. The decision was made to continue the release into November until the deficit was refunded and subsequently, an additional 536 dam^3 (435 acre-feet) was delivered at the International Boundary from November 1 to 13.

No irrigation usage was reported in the Frenchman River Basin after August 20; however, due to the higher than normal precipitation in September, it was estimated that additional domestic usage occurred during the period. The calculations of natural flow were amended to reflect the additional estimated domestic usage.

The division of the Frenchman River natural flow is summarized in Tables 5 and 5A, which follow. The detailed computation of the natural flow is given in Table 14 and the historical summary in Table 15 of Appendix A.

TABLE 5

SUMMARY OF FRENCHMAN RIVER DIVISION[1]

1986

QUANTITIES IN CUBIC DECAMETRES

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 10	49 536	24 768	31 121	6 353	
MAR 11 - MAR 20	18 983	9 492	17 090	7 598	
MAR 21 - MAR 31	4 718	2 359	3 707	1 348	
APR 1 - APR 10	2 424	1 212	1 325	113	
APR 11 - APR 20	1 917	959	1 269	310	
APR 21 - APR 30	1 547	774	962	188	
MAY 1 - MAY 10	4 036	2 018	3 212	1 194	
MAY 11 - MAY 20	5 539	2 770	4 887	2 117	
MAY 21 - MAY 31	4 819	2 410	3 457	1 047	
JUN 1 - JUN 10	2 561	1 281	1 350	69	
JUN 11 - JUN 20	1 197	599	871	272	
JUN 21 - JUN 30	767	384	356		28
JUL 1 - JUL 10	463	232	160		72
JUL 11 - JUL 20	515	258	306	48	
JUL 21 - JUL 31	658	329	574	245	
AUG 1 - AUG 10	241	121	234	113	
AUG 11 - AUG 20	102	51	77	26	
AUG 21 - AUG 31	13	7	13	6	
SEP 1 - SEP 10	0	0	1	1	
SEP 11 - SEP 20	22	11	22	11	
SEP 21 - SEP 30	1 625	813	612		201
OCT 1 - OCT 10	4 204	2 102	1 191		911
OCT 11 - OCT 20	477	239	481	242	
OCT 21 - OCT 31	643	322	782	460	
TOTAL	107 007	53 511	74 060		

[1] This is a summary of data from Table 14, Appendix A.

TABLE 5A

SUMMARY OF FRENCHMAN RIVER DIVISION[1]

1986

QUANTITIES IN ACRE-FEET

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 10	40,159	20,079	25,230	5,150	
MAR 11 - MAR 20	15,390	7,695	13,855	6,160	
MAR 21 - MAR 31	3,825	1,912	3,005	1,093	
APR 1 - APR 10	1,965	983	1,074	92	
APR 11 - APR 20	1,554	777	1,029	251	
APR 21 - APR 30	1,254	627	780	152	
MAY 1 - MAY 10	3,272	1,636	2,604	968	
MAY 11 - MAY 20	4,490	2,246	3,962	1,716	
MAY 21 - MAY 31	3,907	1,954	2,803	849	
JUN 1 - JUN 10	2,076	1,039	1,094	56	
JUN 11 - JUN 20	970	486	706	221	
JUN 21 - JUN 30	622	311	289		23
JUL 1 - JUL 10	375	188	130		58
JUL 11 - JUL 20	418	209	248	39	
JUL 21 - JUL 31	533	267	465	199	
AUG 1 - AUG 10	195	98	190	92	
AUG 11 - AUG 20	83	41	62	21	
AUG 21 - AUG 31	11	6	11	5	
SEP 1 - SEP 10	0	0	1	1	
SEP 11 - SEP 20	18	9	18	9	
SEP 21 - SEP 30	1,317	659	496		163
OCT 1 - OCT 10	3,408	1,704	966		739
OCT 11 - OCT 20	387	194	390	196	196
OCT 21 - OCT 31	521	261	634	373	
TOTAL	86,751	43,381	60,041		

[1] All values are conversions of data from Table 5. Totals and shares may not add or subtract exactly as a result of rounding.

ANNEX A

TREATY BETWEEN THE UNITED STATES AND GREAT BRITAIN RELATING TO BOUNDARY WATERS, AND QUESTIONS ARISING BETWEEN THE UNITED STATES AND CANADA - ARTICLE VI

INTERNATIONAL JOINT COMMISSION
1921 Order

TREATY
BETWEEN THE UNITED STATES AND GREAT BRITAIN
RELATING TO BOUNDARY WATERS,
AND QUESTIONS ARISING BETWEEN THE
UNITED STATES AND CANADA

ARTICLE VI

The High Contracting Parties agree that the St. Mary and Milk rivers and their tributaries (in the State of Montana and the Provinces of Alberta and Saskatchewan) are to be treated as one stream for the purposes of irrigation and power, and the waters thereof shall be apportioned equally between the two countries, but in making such equal apportionment more than half may be taken from one river and less than half from the other by either country so as to afford a more beneficial use to each. It is further agreed that in the division of such waters during the irrigation season, between the 1st of April and 31st of October, inclusive, annually, the United States is entitled to a prior appropriation of 500 cubic feet per second of the waters of the Milk River, or so much of such amount as constitutes three-fourths of its natural flow, and that Canada is entitled to a prior appropriation of 500 cubic feet per second of the flow of St. Mary River, or so much of such amount as constitutes three-fourths of its natural flow.

The Channel of the Milk River in Canada may be used at the convenience of the United States for the conveyance, while passing through Canadian territory, of waters diverted from the St. Mary River. The provisions of Article II of this treaty shall apply to any injury resulting to property in Canada from the conveyance of such waters through the Milk River.

The measurement and apportionment of the water to be used by each country shall from time to time be made jointly by the properly constituted reclamation officers of the United States and the properly constituted irrigation officers of His Majesty under the direction of the International Joint Commission.

INTERNATIONAL JOINT COMMISSION

ORDER

IN THE MATTER OF THE MEASUREMENT AND APPORTIONMENT OF THE WATERS OF THE ST. MARY AND MILK RIVERS AND THEIR TRIBUTARIES IN THE STATE OF MONTANA AND THE PROVINCES OF ALBERTA AND SASKATCHEWAN.

Whereas by Article VI of the Treaty entered into between the United States of America and His Majesty, the King of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas, Emperor of India, signed at Washington on the 11th of January, 1909;

And whereas, the said Reclamation and Irrigation Officers have been unable to agree as to the manner in which the waters mentioned in the said Article VI should be measured and apportioned;

And whereas, before giving directions as to the measurement and apportionment of the said waters, the International Joint Commission deemed it proper to hear such representations and suggestions thereon as the Governments of the United States and Canada, the Provinces of Alberta and Saskatchewan, and the State of Montana, and as corporations and persons interested might see fit to make, and for such purposes sittings of the Commission were held at the following times and places: At the city of St. Paul, in the State of Minnesota, on the 24th, 25th, 26th, 27th, and 28th days of May, 1915; at the city of Detroit, in the State of Michigan, on the 15th, 16th, and 17th days of May, 1917; at the city of Ottawa, in the Province of Ontario, on the 3rd, 4th, and 5th days of May, 1920; at the village of Chinook, in the State of Montana, on the 15th day of September, 1921; and at the city of Lethbridge, in the Province of Alberta, on the 17th day of September, 1921, when counsel and representatives of the said Governments, corporations, and persons appeared and presented their views;

And whereas, pending final decision as to the proper method of measuring and apportioning said waters, interim orders with reference thereto have been made by the International Joint Commission from time to time, the last of such orders bearing the date of 5th day of April, 1921;

And whereas the members of the International Joint Commission have unanimously determined that the said Reclamation and Irrigation Officers should be guided in the measurement and apportionment of said waters by the directions and instructions hereinafter set forth;

IT IS THEREFORE ORDERED AND DIRECTED by the Commission in pursuance of the powers conferred by the said Article VI of the said Treaty that the Reclamation and Irrigation Officers of the United States and Canada shall, until this order is varied, modified, or withdrawn by the Commission, make jointly the measurement and apportionment of the water to be used by the United States and Canada in accordance with the following rules:

St. Mary River

I. (a) During the irrigation season when the natural flow of the St. Mary River at the point where it crosses the international boundary is six hundred and sixty-six (666) cubic feet per second or less Canada shall be entitled to three-fourths and the United States to one-fourth of such flow.

(b) During the irrigation season when the natural flow of the St. Mary River at the point where it crosses the international boundary is more than six hundred and sixty-six (666) cubic feet per second Canada shall be entitled to a prior appropriation of five hundred (500) cubic feet per second, and the excess over six hundred and sixty-six (666) cubic feet per second shall be divided equally between the two countries.

(c) During the non-irrigation season the natural flow of the St. Mary River at the point where it crosses the international boundary shall be divided equally between the two countries.

Milk River

II. (a) During the irrigation season when the natural flow of the Milk River at the point where it crosses the international boundary for the last time (commonly and hereafter called the Eastern Crossing) is six hundred and sixty-six (666) cubic feet per second or less, the United States shall be entitled to three-fourths and Canada to one-fourth of such natural flow.

(b) During the irrigation season when the natural flow of the Milk River at the Eastern Crossing is more than six hundred and sixty-six (666) cubic feet per second the United States shall be entitled to a prior appropriation of five hundred (500) cubic feet per second and the excess over six hundred and sixty-six (666) cubic feet per second shall be divided equally between the two countries.

(c) During the non-irrigation season the natural flow of the Milk River at the Eastern Crossing shall be divided equally between the two countries.

Eastern Tributaries of Milk River

III. The natural flow of the eastern (otherwise known as the Saskatchewan or northern) tributaries of the Milk River at the points where they cross the international boundary shall be divided equally between the two countries.

Waters not naturally crossing the boundary

IV. Each country shall be apportioned such waters of the said rivers and of any tributaries thereof as rise in that country but do not naturally flow across the international boundary.

V. For the purpose of carrying out the apportionment directed in Paragraphs I, II, and III hereof the said Reclamation and Irrigation Officers shall jointly take steps:

(a) To ascertain and keep a daily record of the natural flow of the St. Mary River at the international boundary, of the Milk River at the Eastern Crossing, and of the eastern tributaries of the Milk River at the international boundary by measurement in each case:

(1) At the gauging station at the international boundary;

(2) At all places where any of the waters which would naturally flow across the international boundary at that particular point are diverted in either country prior to such crossing;

(3) At all places where any of the waters which would naturally flow across the international boundary at that particular point are stored, or the natural flow thereof increased or decreased prior to such crossing.

(b) To fix the amount of water to which each country is entitled in each case by applying the directions contained in paragraphs 1, 2, and 3 hereof to the total amount of the natural flow so ascertained in each case.

(c) To communicate the amount so fixed to all parties interested, so that the apportionment of the said waters may be fully carried out by both countries in accordance with the said directions.

VI. Each country may receive its share of the said waters as so fixed at such point or points as it may desire. A gauging station shall be established and maintained by the Reclamation or Irrigation Officers of the country in which any diversion, storage, increase or decrease of the natural flow shall be made at every point where such diversion, storage, increase, or decrease takes place.

VII. International gauging stations shall be maintained at the following points:

St. Mary River near international boundary; the north branch of Milk River near international boundary; the south branch of Milk River near international boundary; Milk River at Eastern Crossing; Lodge Creek, Battle Creek, and Frenchman River, near international boundary; and gauging stations shall be established and maintained at such other points as the Commission may from time to time approve.

VIII. The said Reclamation and Irrigation Officers are hereby further authorized and directed:

(a) To make such additional measurements and to take such further and other steps as may be necessary or advisable in order to insure the

apportionment of the said waters in accordance with the directions herein set forth.

(b) To operate the irrigation works of either country in such a manner as to facilitate the use by the other country of its share of the said waters and subject hereto to secure to the two countries the greatest beneficial use thereof.

(c) To report to the Commission the measurements made at all international and other gauging stations established pursuant to this order.

IX. In the event of any disagreement in respect to any matter or thing to be done under this order the said Reclamation and Irrigation Officers shall report to the Commission, setting forth fully the points of difference and the facts relating thereto.

X. The said order of the Commission, dated the 6th day of April 1921, is hereby withdrawn, except with respect to the report to be furnished to the Commission thereunder.

Dated at Ottawa, Canada, this 4th day of October, 1921.

O. GARDNER,
C. A. MACGRATH,
C. D. CLARK,
HENRY A. POWELL,
W. H. HEARST,
MARK A. SMITH.

ANNEX B

International System of Units

(SI) Conversions

INCH-POUND TO INTERNATIONAL SYSTEM OF UNITS (SI) CONVERSION

Since 1975, the Report to the International Joint Commission on the Division of the Waters of the St. Mary and Milk Rivers has used dual units (SI and inch-pound).

The two inch-pound units that were used in previous reports were cfs-days and acre-feet.

1 cfs-day = 86,400 cubic feet

1 acre-foot = 43,560 cubic feet

1 cfs-day = 1.9835 acre-feet

The SI unit replacing the inch-pound units is the cubic decametre (dam^3).

1 dam^3 = 1000 cubic metres

1 cubic metre = 35.315 cubic feet

1 dam^3 = 35,315 cubic feet

1 acre-foot = 1.2335 dam^3

1 cfs-day = 2.4466 dam^3

1 dam^3 = 0.8107 acre-foot

ANNEX C

List of Gauging Stations

INTERNATIONAL GAUGING STATIONS OPERATED JOINTLY

BY

THE UNITED STATES AND CANADA

ST. MARY AND MILK RIVER DRAINAGE BASINS

1986

Map Index	Station Name
	ST. MARY RIVER BASIN
05AE027	St. Mary River at International Boundary
05AE029	St. Mary Canal at St. Mary Crossing near Babb, Montana
05AE033	Swiftcurrent Creek at Sherburne, Montana
05AE036	Lake Sherburne at Sherburne, Montana
	MILK RIVER BASIN
11AA001	North Milk River near International Boundary
11AA005	Milk River at Milk River
11AA025	Milk River at Western Crossing of International Boundary
11AA031	Milk River at Eastern Crossing of International Boundary
11AA032	North Fork Milk River above St. Mary Canal near Browning, Montana.
11AA033	South Fork Milk River near Babb, Montana
11AA038	Verdigris Coulee near the Mouth
	LODGE CREEK TRIBUTARY BASIN
11AB008	Middle Creek above Lodge Creek
11AB001	Middle Creek below Middle Creek Reservoir
11AB108	Middle Creek near Govenlock
11AB009	Middle Creek near Saskatchewan Boundary
11AB060	Spangler Ditch near Govenlock
11AB080	Middle Creek Reservoir

BATTLE CREEK TRIBUTARY BASIN

11AB083	Lodge Creek below McRae Creek at International Boundary
11AB089	Altawan Reservoir near Govenlock
11AB018	Nashlyn Canal near Consul
11AB027	Battle Creek at International Boundary
11AB044	McKinnon Ditch near Consul
11AB058	Richardson Ditch near Consul
11AB075	Lyons Creek at International Boundary
11AB077	Cypress Lake West Outflow Canal
11AB078	Cypress Lake West Inflow Canal
11AB084	Vidora Ditch near Consul
11AB085	Cypress Lake West Inflow Canal Drain
11AB102	Gaff Ditch near Merryflat

FRENCHMAN RIVER TRIBUTARY BASIN

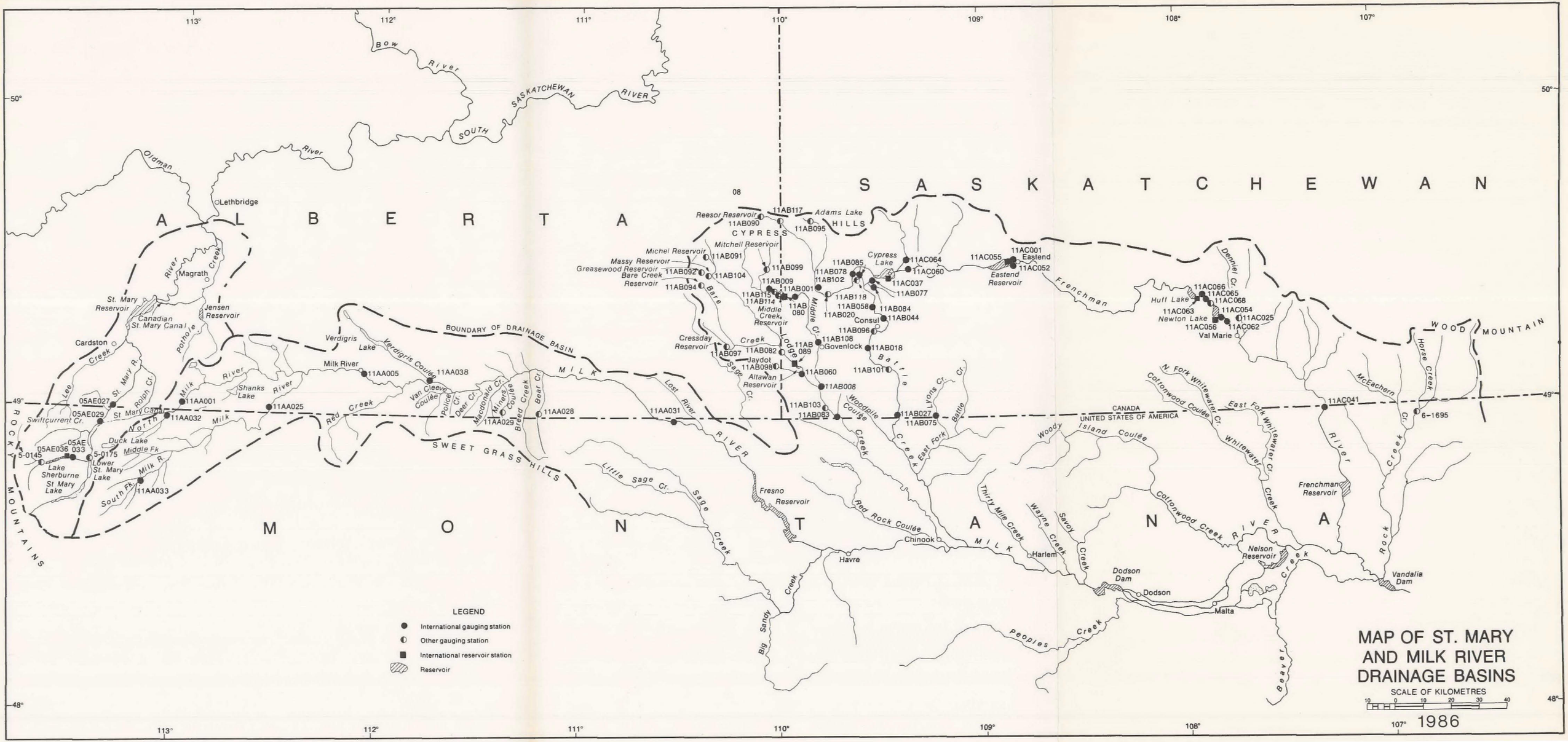
11AC001	Frenchman River below Eastend Reservoir
11AC037	Cypress Lake
11AC041	Frenchman River at International Boundary
11AC052	Eastend Canal near Eastend
11AC054	Newton Lake Main Canal
11AC055	Eastend Reservoir
11AC056	Newton Lake
11AC060	Cypress Lake East Outflow Canal
11AC062	Frenchman River below Newton Lake
11AC063	Huff Lake
11AC064	Belanger Creek Diversion to Cypress Lake
11AC065	Huff Lake Gravity Canal
11AC066	Huff Lake Pumping Canal

GAUGING STATIONS OPERATED INDEPENDENTLY BY EITHER THE UNITED STATES OR CANADA IN THE HEADWATERS OF THE ST. MARY AND MILK RIVER DRAINAGE BASINS 1986

Map Index	Station Name	Operated By
	ST. MARY RIVER BASIN	
5-0145*	Swiftcurrent Creek at Many Glacier, Montana	U.S.A.
5-0175*	St. Mary River near Babb, Montana	U.S.A.
	MILK RIVER BASIN	
11AA028*	Bear Creek near International Boundary	Canada
11AA029*	Miners Coulee near International Boundary	Canada
	LODGE CREEK TRIBUTARY BASIN	
11AB082*	Lodge Creek at Alberta Boundary	Canada
11AB091	Michel Reservoir near Elkwater	Canada
11AB092	Greasewood Reservoir near Elkwater	Canada
11AB094	Bare Creek Reservoir near Elkwater	Canada
11AB097	Cressday Reservoir near Cressday	Canada
11AB098	Jaydot Reservoir near Jaydot	Canada
11AB099	Mitchell Reservoir near Elkwater	Canada
11AB103	Squaw Coulee near Willow Creek	Canada
11AB104	Massy Reservoir near Elkwater	Canada
11AB114	Middle Creek Reservoir Bedford Outlet	Canada
11AB115	Middle Creek Reservoir Flood Spillway	Canada

Map Index	Station Name	Operated By
	BATTLE CREEK TRIBUTARY BASIN	
11AB020*	Shepherd Ditch near Consul	Canada
11AB090	Reesor Reservoir near Elkwater	Canada
11AB095	Adams Lake	Canada
11AB096*	Battle Creek near Consul	Canada
11AB101*	Battle Creek below Nashlyn Project	Canada
11AB117*	Battle Creek at Alberta Boundary	Canada
11AB118*	Battle Creek below Wilson's Weir	Canada
	FRENCHMAN RIVER TRIBUTARY BASIN	
11AC025*	Denniel Creek near Val Marie	Canada
11AC068	Val Marie Pump No. 1	Canada
	ROCK CREEK TRIBUTARY BASIN	
6-1695*	Rock Creek below Horse Creek near International Boundary	U.S.A.

* Data not included in this report or appendices


MAP OF ST. MARY AND MILK RIVER DRAINAGE BASINS
SCALE OF KILOMETRES
10 0 10 20 30 40
1986
LEGEND
International gauging station
Other gauging station
International reservoir station
Reservoir
ALBERTA
SASKATCHEWAN
MONTANA
CANADA
UNITED STATES OF AMERICA
BOUNDARY OF DRAINAGE BASIN
MILK RIVER
SWEET GRASS HILLS
CYPRESS HILLS
WOOD MOUNTAIN
ROCKY MOUNTAINS
Lethbridge
Cardston
Milk River
Havre
Chinook
Harlem
Malta
Dodson
Fresno Reservoir
St. Mary Reservoir
Canadian St. Mary Canal
Jensen Reservoir
Verdigris Lake
Lake Sherburne
St Mary Lake
Lower St. Mary Lake
Middle Creek Reservoir
Cressday Reservoir
Altawan Reservoir
Eastend Reservoir
Cypress Lake
Frenchman Reservoir
Nelson Reservoir
Dodson Dam
Vandalia Dam
Val Marie
Huff Lake
Newton Lake
Consul
Govenlock
Jaydot
Eastend
Reesor Reservoir
Adams Lake
Mitchell Reservoir
Michel Reservoir
Massy Reservoir
Greasewood Reservoir
Bare Creek Reservoir
Oldman River
Bow River
South Saskatchewan River
Magrath
Pothole Creek
Verdigris Coulee
Van Cleeve Coulee
Police Cr
Deer Cr
Macdonald Cr
Miners Coulee
Breed Creek
Bear Cr
Red Creek
Shanks Lake
Lee Creek
Switchcurrent Cr
Duck Lake
Middle Fk
North Fk
South Fk
Milk R
St Mary R
Rolph Cr
Lost River
Little Sage Cr
Sage Creek
Big Sandy Creek
Peoples Creek
Beaver Creek
Rock Creek
Horse Creek
McEachern Cr
Dennel Cr
Frenchman
Woodpile Coulee
Lyons Cr
Battle Creek
East Fork Battle Creek
Barrie Creek
Thirty Mile Creek
Wayne Creek
Savoy Creek
Woody Island Coulee
Cottonwood Coulee
Cottonwood Creek
N Fork Whitewater Cr
East Fork Whitewater Cr
Whitewater Creek
Red Rock Coulee
Middle Cr
Lodge Creek
Sage Cr
Bare Creek
Milk River
11AA001
11AA005
11AA025
11AA028
11AA029
11AA031
11AA032
11AA033
11AA038
05AE027
05AE029
05AE036
05AE033
5-0145
5-0175
6-1695
11AC041
11AB117
11AB090
11AB095
11AB091
11AB104
11AB092
11AB094
11AB099
11AB009
11AB001
11AB115
11AB114
11AB080
11AB089
11AB082
11AB097
11AB098
11AB060
11AB008
11AB103
11AB063
11AB027
11AB075
11AB085
11AB078
11AB102
11AB118
11AB058
11AB020
11AB096
11AB108
11AB018
11AB101
11AB084
11AB044
11AC064
11AC060
11AC037
11AC077
11AC055
11AC001
11AC052
11AC066
11AC065
11AC068
11AC063
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11AC056
11AC062
11AC025
08
48°
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Report to the International Joint Commission on the division and use of the waters of the St. Mary and Milk Rivers...