Report to

THE INTERNATIONAL JOINT COMMISSION

on

THE DIVISION AND USE MADE OF THE WATERS OF

ST. MARY AND MILK RIVERS

by

L. B. LEOPOLD
representing United States

and

J. D. McLEOD
representing Canada

1957

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International Joint Commission,

Washington, D.C., and Ottawa, Ontario.

Gentlemen:

In compliance with the Provisions of Clause VIII (c) of your Order of the 4th October, 1921, directing the division of the waters of 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, 1957.

Respectfully submitted,

L. B. Leopold
Accredited Officer of the United States.

J. D. McLeod
Accredited Officer of Her Majesty.

20 March, 1958.
(date)

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TABLES

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Introduction

The field work incidental to the division and administration of the waters of the St. Mary and Milk Rivers in Alberta, Saskatchewan and Montana was conducted during the irrigation season of 1957 by representatives of the United States Geological Survey and the Water Resources Branch (Canada).

Dr. L. B. Leopold, Chief Hydraulic Engineer, United States Geological Survey, as accredited officer of the United States, was represented in the field by Mr. C. S. Heidel, Staff Engineer, Helena, Montana. Mr. J. D. McLeod, Chief Engineer, Water Resources Branch, Department of Northern Affairs and National Resources, acting in the capacity of accredited officer of Her Majesty, was represented in the field by Mr. E. P. Collier, District Engineer, Calgary, Alberta.

The waters of the two rivers were divided between the two countries in accordance with the Order of the International Joint Commission dated at Ottawa, Canada, on the 4th day of October, 1921.

The hydrometric data upon which this report is based were collected and compiled jointly for 36 international stations by engineers of the Water Resources Branch (Canada) under the direction of Mr. Collier and of the United States Geological Survey under the supervision of Mr. Heidel. Data for another 19 stations in Canada and 7 stations in the United States were collected independently by the same engineers in their respective countries. The United States Bureau of Reclamation furnished data for another 8 canal stations in Montana.

Complete data for 51 of the stations mentioned above are contained in the appendix to this report; monthly quantities only for 11 canal stations in Montana are shown in Table 3, page 2, and Table 7. Data for 4

stations maintained by the United States Geological Survey in the St. Mary River basin and 4 stations maintained by Canada in the St. Mary and Milk River basins are not used for purposes of division and are not included in either this report or its appendix.

The new gauging station, on Rock Creek below Horse Creek near the international boundary, was constructed late in the 1956 season.

Reference to this gauging station was made in the 1955 report and the 1957 data is included in the appendix to this report.

This report has been compiled jointly by Mr. F. Stermitz and Mr. E. P. Collier.

Water Supply

St. Mary River

The thirty-sixth annual international survey of snow conditions on the headwaters of Swiftcurrent Creek, a mountainous area considered typical of the headwaters of the St. Mary River, showed the average snow cover at the observation points to be 72.9 inches or 111 percent of 65.5 inches, the mean for the previous 35 years of record. The water content was found to be 34.8 inches or 120 percent of 29.1 inches, the mean for the previous 35 years of record. The run-off during May, June and July, measured at the gauging station on Swiftcurrent Creek at Many Glacier was 70,360 acre-feet or 103 percent of 68,125 acre-feet, the average of the previous 34 years of record.

The total natural flow of the St. Mary River at the International Boundary for the year November 1, 1956, to October 31, 1957, was 604,627 acre-feet. Of this total, 545,264 acre-feet occurred during the irrigation season, April 1 to October 31. The natural flow during the irrigation season was 92 percent of 589,653 acre-feet, the average of the previous

54 years of record. Of the total natural flow there was delivered to Canada 429,130 acre-feet, 382,820 acre-feet during the irrigation season and 46,310 acre-feet during the balance of the year.

Milk River

The estimated natural flow of the Milk River at its eastern crossing of the International Boundary, during the period March 1 to October 31, 1957, was 104,700 acre-feet or 91 percent of 115,500 acre-feet, the estimated average for the previous 45 years of record.

Eastern Tributaries of Milk River

The fifth annual snow survey in the basins of the eastern tributaries of the Milk River in Canada was conducted by the Water Resources Branch, Canada, between February 25 and February 27, 1957. The average snow cover at the observation points was found to be 7.7 inches as compared to 13 inches in 1956, 10.4 inches in 1955, 4.4 inches in 1954 and 10.3 inches in 1953. The average water content was found to be 2.1 inches as compared to 3.4 inches in 1956, 2.8 inches in 1955, 1.2 inches in 1954 and 2.1 inches in 1953. No attempt will be made to correlate snow cover with subsequent runoff in the eastern tributaries until data for several more years have been obtained.

The total quantity of water delivered to the United States by the eastern tributaries of the Milk River during the period, March 1 to October 31, 1957, was 72,270 acre-feet or 48 percent of 149,500 acre-feet, the average for the previous 30 years. The quantities delivered to the United States by the various tributaries are listed in Table 8.

During the season a total of 36,415 acre-feet was diverted from the eastern tributaries in Canada to irrigation canals or storage. These diversions are listed in Table 6. The consumptive use was less than the total

diversion shown because of return flow from irrigation projects. Measured diversions in Montana amounted to 11,590 acre-feet. These are listed in Table 7.

Division of Water

St. Mary River

The division of the waters of the St. Mary River was carried out in accordance with the Order of the International Joint Commission dated October 4, 1921, which stipulates:

"(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."

The daily natural flow of the St. Mary River was determined in the following manner:

(1) Daily records were obtained at the following gauging and climatologic stations:

1. Lake Sherburne (formerly called Sherburne Lake Reservoir), Daily Storage or Release.

2. United States St. Mary Canal at St. Mary Crossing near Babb (United States Diversion from St. Mary River Basin).

3. St. Mary River at International Boundary (Quantity delivered to Canada).

4. Evaporation and Precipitation station near Babb, Montana.

(2a) When water was being stored in Lake Sherburne, the natural flow of the St. Mary River at the international boundary was considered to be the sum of the quantities measured at gauging stations 1, 2 and 3 above. This sum is the total of the United States storage and diversion and the quantity delivered to Canada.

(2b) When water was being released from Lake Sherburne, the natural flow of the St. Mary River at the international boundary was computed by adding the quantities measured at gauging stations 2 and 3 above, and subtracting the quantity measured at station 1; that is, the natural flow was considered to be the sum of the quantity diverted in the United States St. Mary Canal and that delivered to Canada reduced by the quantity released from Lake Sherburne.

(3) In order to synchronize Lake Sherburne operations with flow quantities at the international boundary, a two-day time lag was applied to data from station 1.

(4) The natural flow of the St. Mary River having been determined, the division of its waters was carried out in accordance with the above Order.

(5) Computed evaporation losses from Lake Sherburne were treated as storage by the United States.

During the irrigation season, April 1 to October 31, field engineers of both countries made frequent computations of the daily natural flow of the river and each country's share thereof, in order that any appropriation by the United States in excess of their share could be adjusted by a subsequent delivery to Canada of an equivalent amount at the earliest opportunity. No such adjustment was made during the 1957 season.

Regular interim reports on the progress of the division of the natural flow at the international boundary were made to interested agencies throughout the irrigation season.

During the non-irrigation season, November 1, 1956, to March 31, 1957, no interim reports were made as the only United States use during this period was storage in Lake Sherburne where the contributing drainage area is only about 13 percent of the total area of the St. Mary River drainage basin in the United States.

The United States St. Mary Canal was operated between April 20 and October 3 and water was delivered to the North Branch of the Milk River from April 22 to October 6.

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 discharge of 172,390 acre-feet which passed the gauging station on the United States St. Mary Canal at St. Mary Crossing between April 20 and October 3 was considered to be the quantity diverted from the St. Mary River by the United States. A total of 165,684 acre-feet was delivered to the North Branch of Milk River at Hudson Bay Divide during the season, from where it was conveyed to irrigation projects in Montana via the Milk River.

Storage in Lake Sherburne was 8,450 acre-feet on October 31, 1956, and had increased to 21,080 acre-feet by March 31, 1957, and to 58,500 acre-feet by July 9, 1957. Thereafter, water was released at varying rates of flow until the end of the season. On October 31, 1957, the storage had been reduced to 9,950 acre-feet.

Canada diverted 327,706 acre-feet of water from the St. Mary River Reservoir in 1957 as measured at the Canadian St. Mary Canal and Magrath Irrigation District Canal gauging stations near Spring Coulee.

Milk River

No division of the flow of Milk River at Eastern Crossing was made in 1957. Except for a few small unmeasured diversions above the eastern crossing of the international boundary, the entire natural flow of the Milk River at that point was delivered to the United States.

Eastern Tributaries of Milk River

Minor Diversions

There are a number of small diversions from the eastern tributaries of Milk River in Saskatchewan for which only estimates of the quantities diverted are available. These estimates were provided by the Water Rights Division of the Province of Saskatchewan and are based on reports from the individual irrigators. It is considered that the quantities diverted do not justify the expense of gauging these small diversions. These estimates, being incomplete and of doubtful value, are not used in the Frenchman River and Battle Creek division computations in Tables 4 and 5, except as an adjustment to the totals for the season. The estimated quantities reported to date for 1957 are, however, shown in Table 6 and also detailed in the appendix to this report.

Battle Creek

Computation of the natural flow of Battle Creek at the international boundary was initiated in 1956 and formal division in the field began in July 1956. The 1957 season was the first full season in which a formal division was carried out. The computed natural flow of Battle Creek at the international boundary for the period March 1 to October 31, 1957, was 27,487 acre-feet, of which each country was entitled to fifty percent. The details of this division are shown in Table 4 of this report. Canada used 8,846 acre-feet, including an estimated 1,234 acre-feet in minor diversions as detailed in the appendix, and delivered 18,641 acre-feet to the United States.

Frenchman River

The computed natural flow of the Frenchman River at the international

boundary for the period March 1 to October 31, 1957, was 38,848 acre-feet, of which each country was entitled to fifty percent. The details of this division are shown in Table 5 of this report. Canada used 12,326 acre-feet, including an estimated 1,521 acre-feet in minor diversions as detailed in the appendix, and delivered 26,521 acre-feet to the United States.

Lodge Creek

Canada diverted or stored a total of 6,703 acre-feet in the Lodge Creek basin during the period March 1 to October 31, 1957, and delivered 19,860 acre-feet to the United States. The Canadian use mentioned above includes 1,764 acre-feet diverted into the Spangler ditch near Govenlock, 4,830 acre-feet stored in Middle Creek Reservoir and an additional 109 acre-feet in minor diversions as detailed in the appendix.

Description of Tables

The eight tables accompanying this report show the total water available in the St. Mary and Milk River basins, the manner in which it was divided and the use made by each country of its share during the irrigation season.

Table 1 deals with the natural flow of the St. Mary River at the international boundary and its division. It comprises seven pages, one for each month of the irrigation season. The table shows the computed daily natural flow and each country's share thereof. It also shows the recorded flow at international boundary and the quantity diverted by the United States.

Table 2 is a summary of the mean monthly natural flow of the St. Mary River at International Boundary.

Table 3, Page 1, (upper table), shows the monthly discharge of the St. Mary River at the International Boundary, the contributions by

Lee and Rolph Creeks in Canada and the total available to Canada at the St. Mary Reservoir near Spring Coulee.

Table 3, Page 1, (lower table), shows the monthly disposition made by Canada of its share of the natural flow of the St. Mary River at the international boundary.

Table 3, Page 2, (upper table), is a summary by months of the disposition of the United States share of the natural flow of the St. Mary River at the international boundary. It shows the quantities stored in or released from Lake Sherburne, the quantity diverted to the United States St. Mary Canal for delivery to the Milk River basin and the unused portion of the United States share. The table also shows, by months, the measured discharge of the Milk River at Eastern Crossing. This discharge is the sum of the natural flow of the Milk River above its eastern crossing of the international boundary and the water diverted from the St. Mary River basin in the United States. Thus it represents the total quantity available to the United States from the two basins during the irrigation season of 1957.

Table 3, Page 2, (lower table), shows the measured diversions, in acre-feet, from the Milk River to several canals in the United States. These records as well as the data for Fresno and Nelson Reservoirs were furnished by the Milk River Project of the United States Bureau of Reclamation.

Table 4 is a compilation, in ten-day periods, of the natural flow of the Battle Creek at the international boundary. This table consists of three pages. Page 1 shows the Canadian diversion to Cypress Lake; Page 2 shows the Canadian diversion to irrigated lands; Page 3 shows the total quantity used by Canada, the natural flow of Battle Creek at the international boundary, the quantity delivered, the United States share and the excess quantity delivered to the United States.

Table 5 is a compilation, in ten-day periods, of the natural flow of the Frenchman River at the international boundary. This table consists of three pages. Page 1 shows the quantity used by Canada in Cypress Lake and the East End irrigation project; Page 2 shows the quantity used by Canada in the Val Marie irrigation projects; Page 3 shows the total quantity used by Canada, the natural flow of the Frenchman River at international boundary, the United States share thereof and the quantity delivered to the United States.

Table 6 summarizes the available information on the diversions from the Eastern Tributaries of Milk River in Canada in 1957.

Table 7 shows the available information on quantities diverted from the Eastern Tributaries of Milk River in the United States in 1957.

Table 8 shows the measured monthly run-off, in acre-feet, of the Eastern Tributaries of Milk River at the international boundary for the period March 1 to October 31, 1957.

Following the tables is a list of the gauging stations operated jointly by Canada and the United States in the Milk and St. Mary River drainage basins in 1957 and a list of other gauging stations in these basins operated independently by either the United States or Canada. A map showing the location of all these stations is included in this report.

Appendix

An appendix, submitted with this report, under separate cover, contains the result of discharge measurements, summary of monthly discharge and the daily gauge height and discharge data for 51 gauging stations operated during 1957 in the St. Mary and Milk River drainage basins. Details of the Canadian minor diversions, as grouped in Table 6 of the report, are included.

NATURAL FLOW OF ST. MARY RIVER AT INTERNATIONAL BOUNDARY AND ITS DIVISION BETWEEN CANADA AND UNITED STATES. (Cu. ft. per sec.) Table 1.

1957 Dry APRIL	Computed Nat. Flow St. Mary River at Int. Bdry.	Canada's share of St. Mary River Nat. Flow	Estimated Flow of St. Mary River at Int. Bdry.	Canada rec'd more (+) or less (-) than share +	-	U.S. share of St. Mary River.	Storage Factors Lake Sherburne (2-day log applied) Stored	Rled.	Diverted by U.S. St. Mary Canal	Net Used by United States	U.S. used more (+) or less (-) than share. +	-
1	172	129	132	3		43	40		0	40		3
2	169	127	139	12		42	30		0	30		12
3	174	130	139	9		44	35		0	35		9
4	182	136	147	11		46	35		0	35		11
5	202	152	167	15		50	35		0	35		15
6	211	158	171	13		53	40		0	40		13
7	199	149	159	10		50	40		0	40		10
8	201	151	151		0	50	50		0	50	0	
9	140	105	95		10	35	45		0	45	10	
10	137	103	92		11	34	45		0	45	11	
11	147	110	107		3	37	40		0	40	3	
12	153	115	118	3		38	35		0	35		3
13	180	135	135	0		45	45		0	45		0
14	199	149	159	10		50	40		0	40		10
15	215	161	175	14		54	40		0	40		14
16	235	176	200	24		59	35		0	35		24
17	235	176	200	24		59	35		0	35		24
18	230	172	205	33		58	25		0	25		33
19	240	180	215	35		60	25		0	25		35
20	267	200	159		41	67	25		83	108	41	
21	290	218	155		63	72		71	206	135	63	
22	236	177	200	23		59		242	278	36		23
23	301	226	252	26		75		287	336	49		26
24	303	227	220		7	76		328	411	83	7	
25	356	267	220		47	89		287	423	136	47	
26	452	339	236		103	113		220	436	216	103	
27	492	369	292		77	123		250	450	200	77	
28	524	393	372		21	131		307	459	152	21	
29	603	452	447		5	151		323	479	156	5	
30	817	575	517		58	242		206	506	300	58	
31												
Total Sec.-ft.	8,262	6,157	5,976	(265)	(446) 181	2,105	740	2,521	4,067	2,286	(446) 181	(265)
Mean	275	205	199		6.0	70.2	24.7	84.0	136	76.2	6.0	
Ac.-ft.	16,387	12,212	11,853		359	4,175	1,468	5,000	8,067	4,534	359	

NATURAL FLOW OF ST. MARY RIVER AT INTERNATIONAL BOUNDARY AND ITS DIVISION BETWEEN CANADA AND UNITED STATES (Cu. ft. per sec.) Table 1.

1957 Day MAY	Computed Nat. Flow St. Mary River at Int. Bdry.	Canada's share of St. Mary River Nat. Flow	Recorded Flow of St. Mary River nr. Int. Bdry.	Canada rec'd more (+) or less (-) than share +	-	U.S. share of St. Mary River.	Storage Factors Lake Sherburne (2-day lag applied) Stored	Rlsd.	Diverted by U.S. St. Mary Canal	Net Used by United States	U.S. used more (+) or less (-) than share. +	-
1	1,090	712	605		107	378		32	517	485	107	
2	1,494	914	800		114	580	159		535	694	114	
3	1,875	1,104	1,100		4	771	220		555	775	4	
4	2,426	1,380	1,660	280		1,046	188		578	766		280
5	2,977	1,655	2,090	435		1,322	293		594	887		435
6	3,646	1,990	2,480	490		1,656	556		610	1,166		490
7	4,258	2,296	3,030	734		1,962	606		622	1,228		734
8	4,692	2,513	3,470	957		2,179	595		627	1,222		957
9	4,835	2,584	3,470	886		2,251	747		618	1,365		886
10	4,546	2,440	3,220	780		2,106	713		613	1,326		780
11	3,967	2,150	2,890	740		1,817	476		601	1,077		740
12	3,482	1,908	2,560	652		1,574	326		596	922		652
13	3,182	1,758	2,320	562		1,424	268		594	862		562
14	3,656	1,995	2,730	735		1,661	330		596	926		735
15	3,680	2,007	2,670	663		1,673	414		596	1,010		663
16	3,804	2,069	2,500	431		1,735	706		598	1,304		431
17	3,772	2,053	2,370	317		1,719	796		606	1,402		317
18	3,509	1,921	2,220	299		1,588	674		615	1,289		299
19	3,431	1,882	2,220	338		1,549	596		615	1,211		338
20	3,719	2,026	2,460	434		1,693	644		615	1,259		434
21	4,491	2,412	3,180	768		2,079	669		642	1,311		768
22	4,802	2,568	3,180	612		2,234	978		644	1,622		612
23	4,513	2,423	2,990	567		2,090	886		637	1,523		567
24	3,982	2,158	2,680	522		1,824	677		625	1,302		522
25	3,592	1,963	2,460	497		1,629	517		615	1,132		497
26	3,393	1,863	2,350	487		1,530	435		608	1,043		487
27	3,464	1,899	2,330	431		1,565	526		608	1,134		431
28	3,837	2,085	2,600	515		1,752	617		620	1,237		515
29	3,648	1,991	2,770	779		1,657	251		627	878		779
30	3,458	1,896	2,830	934		1,562	1		627	628		934
31	3,423	1,878	2,810	932		1,545		19	632	613		932
Total Sec.-ft.	110,644	60,493	77,045	(16,777) 16,552	(225)	50,151	14,864	51	18,786	33,599	(225)	(16,777) 16,552
Mean	3,569	1,951	2,485	534		1,618	479	1.6	606	1,084		534
Ac.-ft.	219,459	119,986	152,817	32,830		99,473	29,482	101	37,261	66,643		32,830

NATURAL FLOW OF ST. MARY RIVER AT INTERNATIONAL BOUNDARY AND ITS DIVISION BETWEEN CANADA AND UNITED STATES (Cu. ft. per sec.) Table 1.

1957 Day JUNE	Computed Nat. Flow St. Mary River at Int. Bdry.	Canada's share of St. Mary River Nat. Flow	Recorded Flow of St. Mary River nr. Int.Bdry.	Canada rec'd more (+) or less (-) than share +	-	U.S. share of St. Mary River.	Storage Factors Lake Sherburne (2-day lag applied) Stored	Rlsd.	Diverted by U.S. St. Mary Canal	Net Used by United States	U.S. used more (+) or less (-) than share. +	-
1	3,366	1,850	2,770	920		1,516		36	632	596		920
2	3,469	1,901	2,830	929		1,568	7		632	639		929
3	3,475	1,904	2,850	946		1,571		7	632	625		946
4	3,667	2,000	2,970	970		1,667	60		637	697		970
5	3,770	2,052	3,030	978		1,718	106		634	740		978
6	3,958	2,146	3,140	994		1,812	179		639	818		994
7	4,303	2,318	3,310	992		1,985	354		639	993		992
8	4,559	2,446	3,220	774		2,113	700		639	1,339		774
9	4,597	2,465	3,330	865		2,132	642		625	1,267		865
10	4,410	2,372	3,400	1,028		2,038	395		615	1,010		1,028
11	4,022	2,178	3,290	1,112		1,844	117		615	732		1,112
12	3,847	2,090	3,180	1,090		1,757	59		608	667		1,090
13	3,674	2,004	3,070	1,066		1,670		4	608	604		1,066
14	3,546	1,940	2,950	1,010		1,606		10	606	596		1,010
15	3,327	1,830	2,730	900		1,497		4	601	597		900
16	2,938	1,636	2,480	844		1,302		136	594	458		844
17	2,600	1,467	2,250	783		1,133		241	591	350		783
18	2,244	1,289	1,980	691		955		327	591	264		691
19	2,044	1,189	1,700	511		855		259	603	344		511
20	2,122	1,228	1,550	322		894		31	603	572		322
21	2,209	1,271	1,460	189		938	146		603	749		189
22	2,093	1,213	1,380	167		880	112		601	713		167
23	1,819	1,076	1,160	84		743	65		594	659		84
24	1,866	1,100	1,030		70	766	240		596	836	70	
25	1,850	1,092	946		146	758	313		591	904	146	
26	1,801	1,067	893		174	734	321		587	908	174	
27	1,778	1,056	862		194	722	332		584	916	194	
28	1,697	1,015	811		204	682	299		587	886	204	
29	1,681	1,007	802		205	674	292		587	879	205	
30	1,664	999	782		217	665	298		584	882	217	
31												
Total Sec.-ft.	88,396	49,201	66,156	(18,165) 16,955	(1,210)	39,195	5,037	1,055	18,258	22,240	(1,210)	(18,165) 16,955
Mean	2,947	1,640	2,205	565		1,306	168	35.2	609	741		565
Ac.-ft.	175,331	97,589	131,219	33,630		77,742	9,991	2,093	36,214	44,112		33,630

NATURAL FLOW OF ST. MARY RIVER AT INTERNATIONAL BOUNDARY AND ITS DIVISION BETWEEN CANADA AND UNITED STATES (Cu. ft. per sec.) Table 1.

1957 Day JULY	Computed Nat. Flow St. Mary River at Int. Bdry.	Canada's share of St. Mary River Nat. Flow	Recorded Flow of St. Mary River nr. Int. Bdry.	Canada rec'd more (+) or less (-) than share +	-	U.S. share of St. Mary River.	Storage Factors Lake Sherburne (2-day lag applied) Stored	Rlsd.	Diverted by U.S. St. Mary Canal	Net Used by United States	U.S. used more (+) or less (-) than share. +	-
1	1,637	985	744		241	652	311		582	893	241	
2	1,539	936	701		235	603	260		578	838	235	
3	1,504	919	667		252	585	262		575	837	252	
4	1,429	881	650		231	548	211		568	779	231	
5	1,390	862	570		292	528	252		568	820	292	
6	1,343	838	546		292	505	208		589	797	292	
7	1,333	833	522		311	500	229		582	811	311	
8	1,336	835	498		337	501	258		580	838	337	
9	1,357	845	546		299	512	227		584	811	299	
10	1,223	778	562		216	445	72		589	661	216	
11	1,160	747	570		177	413	1		589	590	177	
12	1,194	764	602		162	430	1		591	592	162	
13	1,164	749	626		123	415		58	596	538	123	
14	1,183	758	684		74	425		102	601	499	74	
15	1,171	752	701		51	419		131	601	470	51	
16	1,115	724	710		14	391		196	601	405	14	
17	1,082	708	718	10		374		237	601	364		10
18	1,069	701	701	0		368		233	601	368		0
19	953	643	667	24		310		310	596	286		24
20	923	628	634	6		295		305	594	289		6
21	877	605	610	5		272		322	589	267		5
22	878	606	586		20	272		295	587	292	20	
23	829	581	570		11	248		325	584	259	11	
24	806	570	562		8	236		338	582	244	8	
25	737	535	538	3		202		381	580	199		3
26	727	530	522		8	197		373	578	205	8	
27	743	538	514		24	205		349	578	229	24	
28	701	517	514		3	184		391	578	187	3	
29	656	492	514	22		164		436	578	142		22
30	679	506	522	16		173		421	578	157		16
31	660	495	506	11		165		421	575	154		11
Total Sec.-ft.	33,398	21,861	18,577	(97)	(3,381) 3,284	11,537	2,292	5,624	18,153	14,821	(3,381) 3,284	(97)
Mean	1,077	705	599		106	372	73.9	181	586	478	106	
Ac.-ft.	66,244	43,361	36,847		6,514	22,883	4,546	11,155	36,006	29,397	6,514	

NATURAL FLOW OF ST. MARY RIVER AT INTERNATIONAL BOUNDARY AND ITS DIVISION BETWEEN CANADA AND UNITED STATES (Cu. ft. per sec.) Table 1.

1957 Day AUGUST	Computed Nat. Flow St. Mary River at Int. Bdry.	Canada's share of St. Mary River Nat. Flow	Recorded Flow of St. Mary River at Int. Bdry.	Canada rec'd more (+) or less (-) than share +	-	U.S. share of St. Mary River.	Storage Factors Lake Sherburne (2-day lag applied) Stored	Rlsd.	Diverted by U.S. St. Mary Canal	Net Used by United States	U.S. used more (+) or less (-) than share. +	-
1	706	520	514		6	186		383	575	192	6	
2	655	491	514	23		164		437	578	141		23
3	571	428	506	78		143		513	578	65		78
4	596	447	498	51		149		477	575	98		51
5	540	405	476	71		135		509	573	64		71
6	597	448	469	21		149		445	573	128		21
7	547	410	455	45		137		479	571	92		45
8	522	392	434	42		130		487	575	88		42
9	538	404	420	16		134		466	584	118		16
10	532	399	414	15		133		464	582	118		15
11	541	406	408	2		135		449	582	133		2
12	511	383	390	7		128		459	580	121		7
13	488	366	378	12		122		468	578	110		12
14	485	364	372	8		121		465	578	113		8
15	513	385	366		19	128		428	575	147	19	
16	483	362	366	4		121		454	571	117		4
17	454	340	360	20		114		474	568	94		20
18	448	336	354	18		112		474	568	94		18
19	409	307	344	37		102		501	566	65		37
20	456	342	332		10	114		440	564	124	10	
21	432	324	322		2	108		456	566	110	2	
22	396	297	310	13		99		476	562	86		13
23	415	311	305		6	104		454	564	110	6	
24	422	316	295		21	106		435	562	127	21	
25	357	268	280	12		89		482	559	77		12
26	345	259	275	16		86		489	559	70		16
27	381	286	270		16	95		444	555	111	16	
28	387	290	270		20	97		438	555	117	20	
29	358	268	255		13	90		452	555	103	13	
30	373	280	246		34	93		425	552	127	34	
31	360	270	237		33	90		427	550	123	33	
Total Sec.-ft.	14,818	11,104	11,435	(511) 331	(180)	3,714		14,250	17,633	3,383	(180)	(511) 331
Mean	478	358	369	10.7		120		460	569	109		10.7
Ac.-ft.	29,391	22,024	22,681	657		7,367		28,264	34,975	6,710		657

NATURAL FLOW OF ST. MARY RIVER AT INTERNATIONAL BOUNDARY AND ITS DIVISION BETWEEN CANADA AND UNITED STATES (Cu. ft. per sec.) Table 1.

1957 Day SEPTEMBER	Computed Nat. Flow St. Mary River at Int. Bdry.	Canada's share of St. Mary River Nat. Flow	Recorded Flow of St. Mary River nr. Int. Bdry.	Canada rec'd more (+) or less (-) than share +	-	U.S. share of St. Mary River.	Storage Factors Lake Sherburne (2-day lag applied) Stored	Rlsd.	Diverted by U.S. St. Mary Canal	Net Used by United States	U.S. used more (+) or less (-) than share. +	-
1	323	242	237		5	81		464	550	86	5	
2	329	247	232		15	82		453	550	97	15	
3	263	197	224	27		66		507	546	39		27
4	316	237	228		9	79		460	548	88	9	
5	296	222	228	6		74		480	548	68		6
6	304	228	224		4	76		468	548	80	4	
7	288	216	224	8		72		486	550	64		8
8	303	227	206		21	76		449	546	97	21	
9	301	226	210		16	75		457	548	91	16	
10	244	183	214	31		61		520	550	30		31
11	235	176	210	34		59		521	546	25		34
12	294	220	210		10	74		459	543	84	10	
13	299	224	206		18	75		446	539	93	18	
14	283	212	182		30	71		423	524	101	30	
15	231	173	156		17	58		418	493	75	17	
16	169	127	112		15	42		383	440	57	15	
17	162	122	140	18		40		322	344	22		18
18	275	206	242	36		69		200	233	33		36
19	345	259	224		35	86		87	208	121	35	
20	382	286	265		21	96		0	117	117	21	
21	443	332	242		90	111	105		96	201	90	
22	426	320	219		101	106	121		86	207	101	
23	390	292	202		90	98	110		78	188	90	
24	381	286	190		96	95	121		70	191	96	
25	369	277	194		83	92	119		56	175	83	
26	330	248	186		62	82	93		51	144	62	
27	284	213	186		27	71	56		42	98	27	
28	284	213	194		19	71	67		23	90	19	
29	277	208	190		18	69	65		22	87	18	
30	271	203	182		21	68	70		19	89	21	
31												
Total Sec.-ft.	9,097	6,822	6,159	(160)	(823) 663	2,275	927	8,003	10,014	2,938	(823) 663	(160)
Mean	303	227	205		22.1	75.8	30.9	267	334	97.9	22.1	
Ac.-ft.	18,044	13,531	12,216		1,315	4,512	1,839	15,874	19,862	5,827	1,315	

NATURAL FLOW OF ST. MARY RIVER AT INTERNATIONAL BOUNDARY AND ITS DIVISION BETWEEN CANADA AND UNITED STATES (Cu. ft. per sec.) Table 1.

1957 Day OCTOBER	Computed Nat. Flow St. Mary River at Int. Bdry.	Canada's share of St. Mary River Nat. Flow	Recorded Flow of St. Mary River nr. Int. Bdry.	Canada rec'd more (+) or less (-) than share +	-	U.S. share of St. Mary River.	Storage Factors Lake Sherburne (2-day lag applied) Stored	Rlsd.	Diverted by U.S. St. Mary Canal	Net Used by United States	U.S. used more (+) or less (-) than share. +	-
1	258	194	198	4		64	58		2	60		4
2	265	199	202	3		66	63		0	63		3
3	265	199	198		1	66	67		0	67	1	
4	274	206	206		0	68	68		0	68	0	
5	285	214	206		8	71	79		0	79	8	
6	285	214	206		8	71	79		0	79	8	
7	293	220	210		10	73	83		0	83	10	
8	289	217	210		7	72	79		0	79	7	
9	297	223	210		13	74	87		0	87	13	
10	281	211	210		1	70	71		0	71	1	
11	288	216	210		6	72	78		0	78	6	
12	271	203	210	7		68	61		0	61		7
13	275	206	210	4		69	65		0	65		4
14	283	212	210		2	71	73		0	73	2	
15	335	251	214		37	84	121		0	121	37	
16	271	203	219	16		68	52		0	52		16
17	308	231	224		7	77	84		0	84	7	
18	375	281	275		6	94	100		0	100	6	
19	386	290	280		10	96	106		0	106	10	
20	424	318	280		38	106	144		0	144	38	
21	377	283	285	2		94	92		0	92		2
22	376	282	285	3		94	91		0	91		3
23	377	283	305	22		94	72		0	72		22
24	378	284	280		4	94	98		0	98	4	
25	357	268	255		13	89	102		0	102	13	
26	333	250	260	10		83	73		0	73		10
27	311	233	265	32		78	46		0	46		32
28	337	253	260	7		84	77		0	77		7
29	374	280	270		10	94	104		0	104	10	
30	513	385	390	5		128	123		0	123		5
31	548	411	414	3		137	134		0	134		3
Total Sec.-ft.	10,289	7,720	7,657	(118)	(181) 63	2,569	2,630		2	2,632	(181) 63	(118)
Mean	332	249	247		2.0	82.9	84.8		.06	84.9	2.0	
Ac.-ft.	20,408	15,312	15,187		125	5,096	5,217		4	5,220	125	

Historical Summary
of
Natural Flow of St. Mary River at International Boundary

Table 2

Year	Mean Monthly Discharge In Second-feet During Irrigation Season April - October							Run-off in Acre-feet		
	April	May	June	July	August	September	October	Non Irrigation Season Nov.-Mar.	Irrigation Season Apr.-Oct.	For Year Nov.-Oct.
1901-02	-	-	-	-	-	604 d	477 d	-	65,235 z	65,235 z
1902-03	568	1726	5200	2924	1404	1109	917	57,965	837,816	895,781
1903-04	724	2022	2936	1903	933	420	221	96,361	555,162	651,523
1904-05	304	1215	2461	1642	847	371	772	39,128	461,845	500,973
1905-06	481	1504	2285	1826	946	628	756	51,592	511,287	562,879
1906-07	489	1932	4259	3117	1335	1214	632	124.082	786,048	910,130
1907-08	844	2485	6390	2488	785	462	485	62,436	841,793	904,229
1908-09	606 e	1907	5646	3097	1466	645	453	70,247	836,023	906,270
1909-10	1068	2240	2208	1200	562	544	1114	101,355	541,914	643,269
1910-11	527	2070	3651	1783	1044	1377	676	97,632	673,242	770,874
1911-12	527	1984	2295	1644	882	547	423	58,340	503,732	562,072
1912-13	749	1913	4519	2024	1162	574	448	70,054	688,735	758,789
1913-14	637	2230	2298	1430	719	584	841	58,564	530,307	588,871
1914-15	575	1644	2251	1722	969	842	739	83,970	530,287	614,257
1915-16	664	1707	4634	3463	1229	947	391	109,773	789,108	898,881
1916-17	453	2215	4104	2427	759	470	378	58,827	654,520	713,347
1917-18	661	1875	3093	1185	763	489	394	91,256	511,779	603,035
1918-19	340	1976	2116	919	498	336	189	49,684	386,479	436,163
1919-20	429	1720	3133	2355	800	572	557	61,025	579,973	640,998
1920-21	646	2664	3713	1809	755	416	499	72,117	636,167	708,284
1921-22	262	2293	3835	1578	642	420	301	64,657	565,880	630,537
1922-23	422	2286	3359	1726	788	482	560	46,975	583,224	630,199
1923-24	393	2080	3152	1534	726	397	302	51,406	520,145	571,551
1924-25	1212	3461	3512	1893	807	542	406	78,748	720,710	799,458
1925-26	670	1254	1073	818	405	751	1142	49,289	371,849	421,138
1926-27	600	2685	5434	2812	1274	1509	1143	74,692	935,423	1,010,115
1927-28	546	3525	2942	2594	921	513	863	112,237	734,376	846,613
1928-29	314	1837	2558	1272	493	291	288	66,375	427,377	493,752
1929-30	1477	2425	2489	1264	511	370	314	48,323	535,575	583,898
1930-31	224	1957	1830	796	592	464	291	38,803	373,888	412,691
1931-32	567	2497	2896	1409	595	307	240	70,869	515,819	586,688
1932-33	416	1764	4339	2169	766	492	685	52,689	643,242	695,931
1933-34	1734	3041	2929	1155	540	323	269	165,221	629,044	794,265
1934-35	392	1841	1716	1516	630	387	235	136,516	467,568	604,084
1935-36	617	2417	2153	823	420	252	162	29,820	414,845	444,665
1936-37	267	1797	3752	1409	435	238	285	34,044	500,701	534,745
1937-38	656	2611	3323	1622	510	360	322	64,641	571,983	636,624
1938-39	640	2271	1721	1069	459	292	188	59,655	402,996	462,651
1939-40	381	1860	1802	737	382	427	415	38,346	364,056	402,402
1940-41	364	1333	1429	879	359	520	635	32,902	334,846	367,748
1941-42	676	1890	2773	1824	754	525	397	94,098	535,668	629,766
1942-43	1240	1596	3722	2691	810	376	328	63,939	675,767	739,706
1943-44	197	1273	1634	809	536	424	374	36,109	318,121	354,230
1944-45	153	2000	3382	1455	457	486	421	46,447	505,676	552,123
1945-46	668	2361	2731	1500	571	495	521	77,246	535,571	612,817
1946-47	913	2729	2585	1634	657	526	1250	85,228	624,962	710,190
1947-48	621	2367	5486	1576	758	329	266	71,286	725,024	796,310
1948-49	526	2337	2272	991	471	532	404	35,421	456,637	492,058
1949-50	462	1969	4517	3159	1100	492	929	95,165	766,778	861,943
1950-51	819	3306	3471	3230	1128	1209	1390	141,779	885,233	1,027,012
1951-52	969	2408	2204	1433	839	409	264	82,362	517,093	599,455
1952-53	635	2716	5594	2519	887	435	283	62,638	786,960	849,598
1953-54	458	3237	3637	3124	1100	771	736	62,529	795,874	858,403
1954-55	257	1491	3755	2248	799	363	310	79,720	589,739	669,459
1955-56	525	2793	3631	2027	828	441	513	88,750	652,395	741,145
1956-57	275	3560	5147	1417	473	343	334	99,363	545,264	604,627
Average	599	2217	3249	1807	770	547	530	71,140	588,846	659,986

This table contains revisions to formerly reported data.

d - 1902 data not used.
e - Average of 1903 to 1955 Aprils used.
z - Partial record not included in average.

Table 2

DIVISION OF FLOW OF ST. MARY RIVER
1957

Water Available to Canada at Spring Coulee
(Acre-feet)

Month	St. Mary River Int. Boundary	Rolph Creek Kimball	Lee Creek Cardston	Total Available at Spring Coulee
April	11,850	1,080	3,650	16,580
May	152,800	861	15,870	169,531
June	131,200	394	7,370	138,964
July	36,850	98	1,490	38,438
August	22,680	137	559	23,376
September	12,220	108	681	13,009
October	15,190	158	1,680	17,028
Total	382,790	2,836	31,300	416,926

DISPOSITION OF CANADIAN SHARE

Water Used in St. Mary and Milk Rivers Development
(Acre-feet)

Month	Canada's Share Natural Flow: Int. Boundary	Canadian St. Mary Canal: Spring Coulee	Magrath I.D. Canal: Spring Coulee	Total Diverted to S.M.R.D.	Available Storage from Canada's Share
April	12,212	0	0	0	12,212
May	119,986	48,850	914	49,764	70,222
June	97,589	72,970	1,720	74,690	22,899
July	43,361	68,610	3,900	72,510	-29,149
August	22,024	62,260	2,990	65,250	-43,226
September	13,531	41,770	1,460	43,230	-29,699
October	15,312	21,880	382	22,262	- 6,950
Total	324,015	316,340	11,366	327,706	- 3,691

Storage in St. Mary Reservoir March 31, Elev. 3599.75 = 177,800 acre-feet
October 31, Elev. 3592.99 = 145,900 acre-feet

DIVISION OF FLOWS OF ST. MARY AND MILK RIVERS
1957

Water Available to the United States in Milk River at Eastern Crossing
including Diversion from St. Mary River
(Acre-feet)

Month	St. Mary River Basin						Milk River Basin
	United States Share Nat. Flow	Lake Sherburne Stored	Lake Sherburne Rlsd.	Total Available for Diversion	Diverted to Milk River Basin	Unused	Measured Flow at Eastern Crossing*
April	4,175	1,468	5,000	7,707	8,067	- 360	25,390
May	99,473	29,482	101	70,092	37,261	32,831	61,640
June	77,742	9,991	2,093	69,844	36,214	33,630	48,400
July	22,883	4,546	11,155	29,492	36,006	-6,514	33,440
Aug.	7,367	0	28,264	35,631	34,975	656	33,940
Sept.	4,512	1,839	15,874	18,547	19,862	-1,315	27,350
Oct.	5,096	5,217	0	- 121	4	- 125	7,370
Total	221,248	52,543	62,487	231,192	172,389	58,803	237,530

* Represents natural flow of Milk River and diversion from St. Mary River Basin. Lake Sherburne quantities are corrected for evaporation.

Storage in Lake Sherburne on March 31 = 21,080 acre-feet
October 31 = 9,950 acre-feet
Storage in Fresno Reservoir on March 31 = 110,200 acre-feet
October 31 = 57,550 acre-feet

DIVERSIONS FROM MILK RIVER
UNITED STATES
1957

(Acre-feet)

Month	Fort Belknap Canal	Paradise Canal	Harlem Canal	Harlem No. 2	Agency Canal	Dodson North	Dodson South	Vandalia Canal	Total
April	1,930	----	595	-----	555	1,210	10,570	----	14,860
May	15,230	6,550	5,040	1,320	4,820	4,920	11,800	5,810	55,490
June	14,590	5,810	3,330	1,210	6,540	4,520	14,680	5,910	56,590
July	19,810	8,020	5,240	1,620	5,560	5,450	16,620	9,010	71,330
Aug.	16,100	8,050	4,720	830	6,390	4,920	19,980	7,430	68,420
Sept.	8,790	6,390	1,150	226	1,890	3,560	15,960	5,950	43,916
Oct.	3,420	543	317	-----	-----	1,530	5,260	5,830	16,900
Nov.	-----	-----	-----	-----	-----	-----	1,150	2,980	4,130
Total	79,870	35,363	20,392	5,206	25,755	26,110	96,020	42,920	331,636

Storage in Nelson Reservoir on March 31, 49,440 acre-feet
on October 31, 54,680 acre-feet

DETERMINATION OF NATURAL FLOW OF BATTLE CREEK AT INTERNATIONAL BOUNDARY
1957

Diversion to Cypress Lake
Quantities in Second-foot Days

Period at International Boundary	West Inflow Canal	West Inflow Canal Drain	Diversion to Cypress Lake	West Outflow Canal	Net Diversion to Cypress Lake
Feb.23 - Mar. 4	Nil	Nil	Nil	Nil	Nil
Mar. 5 - Mar.14	Nil	Nil	Nil	Nil	Nil
Mar.15 - Mar.25	Nil	Nil	Nil	Nil	Nil
Mar.26 - Apr. 4	1.0	Nil	+ 1.0	Nil	+ 1.0
Apr. 5 - Apr.14	371.0	35.8	+ 335.2	1.0	+ 334.2
Apr.15 - Apr.24	893.0	4.1	+ 888.9	0.4	+ 888.5
Apr.25 - May 4	2,719.0	1.9	+ 2,717.1	319.2	+ 2,397.9
May 5 - May 14	203.3	66.8	+ 136.5	91.1	+ 45.4
May 15 - May 25	71.3	77.6	- 6.3	145.1	- 151.4
May 26 - June 4	49.2	54.5	- 5.3	431.2	- 436.5
June 5 -June 14	48.7	49.6	- 0.9	313.0	- 313.9
June 15-June 24	41.8	43.4	- 1.6	98.0	- 99.6
June 25-July 4	46.6	49.2	- 2.6	27.8	- 30.4
July 5-July 14	45.2	50.1	- 4.9	89.8	- 94.7
July 15-July 25	39.3	36.5	+ 2.8	744.3	- 741.5
July 26-Aug. 4	42.0	37.4	+ 4.6	713.0	- 708.4
Aug. 5 - Aug.14	40.7	37.4	+ 3.3	388.6	- 385.3
Aug.15 - Aug.25	63.1	58.8	+ 4.3	63.5	- 59.2
Aug.26 - Sept.4	1.6	1.5	+ 0.1	95.0	- 94.9
Sept. 5-Sept.14	0.0	1.5	- 1.5	100.8	- 102.3
Sept.15-Sept.24	Nil	0.1	- 0.1	85.2	- 85.3
Sept.25- Oct. 4	Nil	Nil	Nil	22.0	- 22.0
Oct. 5 - Oct.14	Nil	0.0	- 0.0	Nil	- 0.0
Oct.15 - Oct.25	Nil	3.3	- 3.3	Nil	- 3.3
Oct.26 - Oct.31	Nil	4.3	- 4.3	Nil	- 4.3
Total	4,676.8	613.8	+ 4,063.0	3,729.0	+ 334.0
Acre-feet	9,276	1,217	8,059	7,396	+ 662

DETERMINATION OF NATURAL FLOW OF BATTLE CREEK
AT INTERNATIONAL BOUNDARY
1957

Diversion to Irrigated Lands
Quantities in Second-foot Days

Period at International Boundary	Stirling & Nash Ditch	McKinnon Ditch	Richardson Ditch	Vidore Ditch	Total Diverted	Return Flow	Net Diversion to Irrigated Lands
Feb.23 - Mar. 4	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Mar. 5 - Mar.14	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Mar.15 - Mar.25	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Mar.26 - Apr. 4	67.8	Nil	Nil	Nil	67.8	20.3	47.5
Apr. 5 - Apr.14	142.1	Nil	Nil	Nil	142.1	42.6	99.5
Apr.15 - Apr.24	107.9	Nil	Nil	Nil	107.9	32.4	75.5
Apr.25 - May 4	176.6	Nil	31.1	29.7	237.4	71.2	166.2
May 5 - May 14	175.5	Nil	47.8	48.0	271.3	81.4	189.9
May 15 - May 25	134.8	113.3	197.9	103.8	549.8	164.9	384.9
May 26 - June 4	102.2	154.0	256.9	143.2	656.3	196.9	459.4
June 5 - June 14	94.4	177.2	11.7	110.8	394.1	118.2	275.9
June 15-June 24	106.6	86.0	0.5	53.4	246.5	74.0	172.5
June 25-July 4	35.8	0.4	0.3	22.6	59.1	17.7	41.4
July 5-July 14	Nil	Nil	25.0	34.1	59.1	17.7	41.4
July 15-July 25	Nil	80.8	242.3	327.3	650.4	195.1	455.3
July 26-Aug. 4	24.4	168.4	238.0	226.7	657.5	197.2	460.3
Aug. 5 - Aug.14	105.8	107.0	160.2	18.6	391.6	117.5	274.1
Aug.15 - Aug.25	41.9	30.1	37.3	Nil	109.3	32.8	76.5
Aug.26 - Sept.4	46.0	18.8	6.8	37.3	108.9	32.7	76.2
Sept. 5-Sept.14	81.8	0.8	0.5	96.8	179.9	54.0	125.9
Sept.15-Sept.24	0.4	Nil	0.6	89.9	90.9	27.3	63.6
Sept.25- Oct. 4	Nil	Nil	0.0	25.1	25.1	7.5	17.6
Oct. 5 - Oct.14	Nil	Nil	0.0	Nil	0.0	0.0	Nil
Oct.15 - Oct.25	Nil	Nil	0.0	Nil	0.0	0.0	Nil
Oct.26 - Oct.31	Nil	Nil	Nil	0.1	0.1	0.0	0.1
Total	1,444.0	936.8	1,256.9	1,367.4	5,005.1	1,501.4	3,503.7
Acre-feet	2,864	1,858	2,493	2,712	9,927	2,978	6,949

DETERMINATION OF NATURAL FLOW OF BATTLE CREEK AT INTERNATIONAL BOUNDARY
1957

Quantities in Second-foot Days

Period at International Boundary	Net Diversion to Cypress Lake	Net Diversion to Irrigated Land	Total Used by Canada	Battle Creek Flow at Int'l Boundary	Battle Creek Natural Flow	United States Share	United States Received in Excess of Share
Feb.23 - Mar. 4	Nil	Nil	Nil	8.0 +	8.0+	4.0 +	4.0
Mar. 5 - Mar.14	Nil	Nil	Nil	20.0 +	20.0+	10.0 +	10.0
Mar.15 - Mar.25	Nil	Nil	Nil	154.5 +	154.5+	77.2 +	77.3
Mar.26 - Apr. 4	+ 1.0	47.5	+ 48.5	1,645.0 +	1,693.5+	846.8 +	798.2
Apr. 5 - Apr.14	+ 334.2	99.5	+ 433.7	1,355.0 +	1,788.7+	894.4 +	460.6
Apr.15 - Apr.24	+ 888.5	75.5	+ 964.0	471.9 +	1,435.9+	718.0 -	246.1
Apr.25 - May 4	+ 2,397.9	166.2	+ 2,564.1	1,340.5 +	3,904.6+	1,952.3 -	611.8
May 5 - May 14	+ 45.4	189.9	+ 235.3	1,413.0 +	1,648.3+	824.2 +	588.8
May 15 - May 25	- 151.4	384.9	+ 233.5	373.4 +	606.9+	303.4 +	70.0
May 26 - June 4	- 436.5	459.4	+ 22.9	176.8 +	199.7+	99.8 +	77.0
June 5 -June 14	- 313.9	275.9	- 38.0	220.0 +	182.0+	91.0 +	129.0
June 15-June 24	- 99.6	172.5	+ 72.9	317.1 +	390.0+	195.0 +	122.1
June 25-July 4	- 30.4	41.4	+ 11.0	268.7 +	279.7+	139.8 +	128.9
July 5-July 14	- 94.7	41.4	- 53.3	185.2 +	131.9+	66.0 +	119.2
July 15-July 25	- 741.5	455.3	- 286.2	252.2 -	34.0-	17.0 +	269.2
July 26-Aug. 4	- 708.4	460.3	- 248.1	222.0 -	26.1-	13.0 +	235.0
Aug. 5 - Aug.14	- 385.3	274.1	- 111.2	162.4 +	51.2+	25.6 +	136.8
Aug.15 - Aug.25	- 59.2	76.5	+ 17.3	101.1 +	118.4+	59.2 +	41.9
Aug.26 - Sept.4	- 94.9	76.2	- 18.7	15.7 -	3.0-	1.5 +	17.2
Sept. 5-Sept.14	- 102.3	125.9	+ 23.6	39.5 +	63.1+	31.6 +	7.9
Sept.15-Sept.24	- 85.3	63.6	- 21.7	90.3 +	68.6+	34.3 +	56.0
Sept.25- Oct. 4	- 22.0	17.6	- 4.4	105.7 +	101.3+	50.6 +	55.1
Oct. 5 - Oct.14	- 0.0	Nil	- 0.0	92.9 +	92.9+	46.4 +	46.5
Oct.15 - Oct.25	- 3.3	Nil	- 3.3	204.8 +	201.5+	100.8 +	104.0
Oct.26 - Oct.31	- 4.3	0.1	- 4.2	162.7 +	158.5+	79.2 +	83.5
Total	+ 334.0	3,503.7	+ 3,837.7	9,398.4	+13,236.1	+6,618.1	+ 2,780.3
Acre-feet	+ 662	6,949	+ 7,612	18,641	+26,253	+13,127	+ 5,515
Estimated acre-feet total of minor diversions detailed in appendix to this report.			1,234		1,234		
			8,846		27,487		

DETERMINATION OF NATURAL FLOW OF FRENCHMAN RIVER AT INTERNATIONAL BOUNDARY
1957

Water used by Canada at Cypress Lake and East End
Quantities in Second-foot-Days

Date at Int'l Boundary	Used at Cypress		Used at East End				Total Used
	Stored	Released	Stored	Released	Diverted	Return Flow	
March							
1 - 10	0	10.0	0		0	0	- 10.0
11 - 20	0	15.0		2	0	0	- 17.0
21 - 31	0	21.0	4		0	0	- 17.0
April							
1 - 10	80.0	10.0	38		0	0	+ 108.0
11 - 20	420.4	437.9	24		0	0	+ 6.5
21 - 30	986.1	40.2	238		0	0	+ 1,183.9
May							
1 - 10	791.0	25.5	487		0	0	+ 1,252.5
11 - 20	88.5	92.2	74		32.3	9.7	+ 92.9
21 - 31	31.9	87.2		139	319.8	95.9	+ 29.6
June							
1 - 10	9.2	74.5		235	449.6	134.9	+ 14.4
11 - 20	0	499.7	187		397.2	119.2	- 34.7
21 - 30	0	50.0		14	192.9	57.9	+ 71.0
July							
1 - 10	0	8.2		60	153.9	46.2	+ 39.5
11 - 20	0	6.4	28		38.6	11.6	+ 48.6
21 - 31	0	4.0		69	114.8	34.4	+ 7.4
Aug.							
1 - 10	0	582.0		118	253.9	76.2	- 522.3
11 - 20	0	749.0		1	202.2	60.7	- 608.5
21 - 31	0	292.7		269	217.7	65.3	- 409.3
Sept.							
1 - 10	0	4.4		8	27.9	8.4	+ 7.1
11 - 20	0	3.8	3		0	0	- 0.8
21 - 30	0	4.9	11		0	0	+ 6.1
Oct.							
1 - 10	0	2.7	3		0	0	+ 0.3
11 - 20	0	8.4	4		0	0	- 4.4
21 - 31	0	14.3	5		0	0	- 9.3
Total	2,407.1	3,044.0	1,106	915	2,400.8	720.4	+ 1,234.5
Mean	9.82	12.4	4.51	3.73	9.80	2.94	5.04
Acre-feet	4,774	6,038	2,194	1,815	4,762	1,429	+ 2,449

DETERMINATION OF NATURAL FLOW OF FRENCHMAN RIVER AT INTERNATIONAL BOUNDARY
1957

Water used by Canada at Val Marie
Quantities in Second-foot Days

Date at Int'l Boundary	Used at Upper Val Marie			Used at Lower Val Marie			Return Flow	Total Used
	Stored	Rls'd	Diverted	Stored	Rls'd	Diverted		
March								
1 - 10	36		0		29	0	0	+ 7.0
11 - 20	4		0	24		0	0	+ 28.0
21 - 31	66		0	1,230		0	0	+1,296.0
April								
1 - 10	127		0	1,079		0	0	+1,206.0
11 - 20		97	0	86		0	0	- 11.0
21 - 30	438		0	360		0	0	+ 798.0
May								
1 - 10	189		10.1		301	0	3.0	- 104.9
11 - 20	3		215.0	342		138.3	106.0	+ 592.3
21 - 31		94	324.6		1,155	667.0	297.5	- 554.9
June								
1 - 10		39	214.2		1,102	661.0	262.6	- 528.4
11 - 20	78		90.4		528	530.2	186.2	- 15.6
21 - 30	77		96.5		251	237.3	100.1	+ 59.7
July								
1 - 10	59		15.9		32	93.8	32.9	+ 103.8
11 - 20	9		30.8		233	197.2	68.4	- 64.4
21 - 31		330	344.7		340	373.6	215.5	- 167.2
Aug.								
1 - 10		2	376.7		180	212.6	176.8	+ 230.5
11 - 20	213		205.0	131		194.1	119.7	+ 623.4
21 - 31	241		71.2		15	175.3	74.0	+ 398.5
Sept.								
1 - 10		16	25.2		8	67.3	27.8	+ 40.7
11 - 20		10	19.9		24	66.9	26.0	+ 26.8
21 - 30	19		21.2		20	0	6.4	+ 13.8
Oct.								
1 - 10	46		0	31		0	0	+ 77.0
11 - 20	23		0	57		0	0	+ 80.0
21 - 31		652	0	730		0	0	+ 78.0
Total	1,628	1,240	2,061.4	4,070	4,218	3,614.6	1,702.9	+4,213.1
Mean	6.64	5.06	8.41	16.6	17.2	14.8	6.95	17.2
Acre-feet	3,229	2,460	4,089	8,073	8,366	7,169	3,378	+8,357

DETERMINATION OF NATURAL FLOW OF FRENCHMAN RIVER
AT INTERNATIONAL BOUNDARY
1947

Quantities in Second-feet Days

Date at Int'l Boundary	Used by Canada: Cypress East End	Used by Canada: Val Marie	Total Used by Canada	Frenchman River: Flow at Sask.	Frenchman River: Natural Flow	United States: Share	United States: Received in Excess of Share
March							
1 - 10	- 10.0	+ 7.0	- 3.0	40.0	37.0	18.5	+ 21.5
11 - 20	- 17.0	+ 28.0	+ 11.0	110.0	121.0	60.5	+ 49.5
21 - 31	- 17.0	+1,296.0	+1,279.0	2,393.0	3,672.0	1,836.0	+ 557.0
April							
1 - 10	+ 108.0	+1,206.0	+1,314.0	1,531.0	2,845.0	1,422.5	+ 108.5
11 - 20	+ 6.5	- 11.0	- 4.5	2,962.0	2,957.5	1,478.8	+ 1,483.2
21 - 30	+1,183.9	+ 798.0	+1,981.9	3,188.0	5,169.9	2,585.0	+ 603.0
May							
1 - 10	+1,252.5	- 104.9	+1,147.6	924.0	2,071.6	1,035.8	- 111.8
11 - 20	+ 92.9	+ 592.3	+ 685.2	194.4	879.6	439.8	- 245.4
21 - 31	+ 29.6	- 554.9	- 525.3	698.1	172.8	86.4	+ 611.7
June							
1 - 10	+ 14.4	- 528.4	- 514.0	544.6	30.6	15.3	+ 529.3
11 - 20	- 34.7	- 15.6	- 50.3	327.0	276.7	138.4	+ 188.6
21 - 30	+ 71.0	+ 59.7	+ 130.7	150.4	281.1	140.6	+ 9.8
July							
1 - 10	+ 39.5	+ 103.8	+ 143.3	81.4	224.7	112.4	- 31.0
11 - 20	+ 48.6	- 64.4	- 15.8	25.4	9.6	4.8	+ 20.6
21 - 31	+ 7.4	- 167.2	- 159.8	61.6	- 98.2	- 49.1	+ 110.7
Aug.							
1 - 10	- 522.3	+ 230.5	- 291.8	25.6	- 266.2	- 133.1	+ 158.7
11 - 20	- 608.5	+ 623.4	+ 14.9	4.8	19.7	9.8	- 5.0
21 - 31	- 409.3	+ 398.5	- 10.8	13.5	2.7	1.4	+ 12.1
Sept.							
1 - 10	+ 7.1	+ 40.7	+ 47.8	13.8	61.6	30.8	- 17.0
11 - 20	- 0.8	+ 26.8	+ 26.0	8.1	34.1	17.0	- 8.9
21 - 30	+ 6.1	+ 13.8	+ 19.9	17.3	37.2	18.6	- 1.3
Oct.							
1 - 10	+ 0.3	+ 77.0	+ 77.3	6.4	83.7	41.8	- 35.4
11 - 20	- 4.4	+ 80.0	+ 75.6	2.0	77.6	38.8	- 36.8
21 - 31	- 9.3	+ 78.0	+ 68.7	48.8	117.5	58.8	- 10.0
Total	+1,234.5	+4,213.1	+5,447.6	13,371.2	18,818.8	9,409.6	+ 3,961.6
Mean	5.04	17.2	22.2	54.6	76.8	38.4	16.2
Acre-feet	+2,449	+8,357	+10,805	26,521	37,327	18,664	+ 7,858
Estimated Acre-feet Total of Minor Diversions detailed in appendix to this report.			1,521		1,521		
			12,326		38,848		

DIVERSIONS FROM THE EASTERN TRIBUTARIES OF MILK RIVER IN CANADA
1957

Quantities in Acre-feet

Lodge Creek Tributary Basin

Middle Creek near Alberta Boundary	6,360[a]	
Released to Lodge Creek from Middle Creek Reservoir	1,530[b]	4,830
Spangler Ditch near Govenlock	2,520	
Estimated return flow from Spangler Ditch	756	1,764
Total of 12 Minor Diversions Detailed in Appendix		109[c]
Total diverted by Canada		6,703

a - Total flow of this station stored in Middle Creek Reservoir.

b - Released from Middle Creek Reservoir via Bedford Slough.

c - 1350 acre-feet diverted by Mitchell Ranching Co. and listed as a Minor Diversion in Appendix is included in Middle Creek near Alberta Boundary.

(Lodge Creek at International Boundary = 19,860 acre-feet)

Battle Creek Tributary Basin

Diverted by Cypress Lake West Inflow Canal		9,276	
Returned by Cypress Lake West Inflow Canal Drain	1,217		
Returned by Cypress Lake West Outflow Canal	7,396	8,613	663
Vidora Ditch near Consul	2,712		
Richardson Ditch near Consul	2,493		
McKinnon Ditch near Consul	1,858		
Stirling and Nash Ditch near Consul	2,864	9,927	
Estimated Return Flow from Irrigated Lands		2,978	6,949
Total of 44 Minor Diversions Detailed in Appendix			1,234
Total Diverted by Canada			8,846

(Battle Creek at International Boundary = 18,641 acre-feet)

Frenchman River Tributary Basin

Belanger Creek Diversion to Cypress Lake		4,774	
Returned by Cypress Lake East Outflow Canal		6,038	- 1,264
Stored in East End Reservoir		2,194	
Released from East End Reservoir		1,815	379
Stored in Val Marie Reservoirs		11,302	
Released from Val Marie Reservoirs		10,826	476
East End Irrigation District Canal	4,762		
Val Marie Irrigation District West Canals	4,089		
Val Marie Main Canal	7,169	16,020	
Estimated Return Flow from Irrigated Lands		4,807	11,213
Total of 43 Minor Diversions Detailed in Appendix			1,521
Total Diverted by Canada			12,325

(Frenchman River at International Boundary = 26,521 acre-feet)

MEASURED DIVERSIONS FROM THE EASTERN TRIBUTARIES

OF MILK RIVER IN THE UNITED STATES

1957

(Quantities in Acre-feet)

Irrigator	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Total
			Lodge Creek						
North Chinook Canal	668	3,300	1,550	131	0	0	0	0	5,650
			Battle Creek						
Matheson Canal	-	-	-	-	-	-	-	-	a140
Pumping	-	-	-	-	-	-	-	-	b410
			Frenchman River						
Frenchman Canal	0	480	1,070	1,570	1,430	804	39	0	5,390
Total	-	-	-	-	-	-	-	-	11,590

a - Stage discharge relation indefinite; discharge, estimated on basis of 1 discharge measurement, engineer's notes, and appearance of the gage-height graph.

b - Estimated use by pumping from Battle Creek to land under the Matheson Canal.

Table 7

Measured Run-off of Eastern Tributaries of Milk River
at International Boundary for period March to October, 1957
(Quantities in Acre-feet)

STREAM	March	April	May	June	July	Aug.	Sept.	Oct.	Total
Lodge Creek	1,110	15,940	2,450	362	1.8	0	0	0	19,860
Woodpile Coulee	45	1,210	6.1	8.9	2.8	0	0	0	1,270
Battle Creek	1,060	6,950	5,650	1,560	1,350	687	406	988	18,650
Lyons Coulee	36	965	0.0	0	0	0	0	0	1,000
East Br. Battle Cr.	165	632	0.0	0	169	0	0	0	966
Whitewater Creek	75	39	13	3.6	0.0	0.0	0.0	2.0	133
Frenchman River	5,040	15,240	3,600	2,030	334	87	78	113	26,520
McEachern Creek	19	32	0.4	0	0	0	0	0	51
Horse Creek	290	37	0.2	0.0	0	0	0	0	327
Rock Creek	1,630	1,270	345	155	16	0	9.5	63	3,490
Totals	9,470	42,315	12,064.7	4,119.5	1,873.6	774	493.5	1,166	72,270

Table 8

GAUGING STATIONS OPERATED JOINTLY BY
CANADA AND UNITED STATES
IN ST. MARY AND MILK RIVER DRAINAGE BASINS

- 1957 -

Map Index	Stream and Location	Remarks
	St. Mary River Basin	
$5AE_{27}$	St. Mary River at International Boundary	Int.[a]
$5AE_{0.5}$	Swiftcurrent Creek at Many Glacier, Montana	Int.[a]
$5AE_{0.9}$	Lake Sherburne at Sherburne, Montana	Int.R[a]
$5AE_{0.6}$	Swiftcurrent Creek at Sherburne, Montana	Int.[a]
$5AE_{0.2}$	United States St. Mary Canal at St. Mary Crossing, near Babb, Montana	Int.[a]
$5AE_{0.3}$	United States St. Mary Canal at Hudson Bay Divide near Browning, Montana	Int.[a]
	Milk River Basin	
$11AA_{5}$	Milk River at Milk River, Alberta	Int.[a]
$11AA_{0.2}$	Milk River at Eastern Crossing of International Boundary	Int.[a]
$11AA_{0.3}$	North Branch of Milk River above St. Mary Canal, near Browning, Montana	Int.[a]
$11AA_{1}$	North Branch of Milk River near International Boundary	Int.[a]
$11AA_{25}$	South Branch of Milk River near International Boundary	Int.[a]
$11AD_{0.1}$	Whitewater Creek near International Boundary	Int.[a]
	Lodge Creek Tributary Basin	
$11AB_{83}$	Lodge Creek below McRae Coulee at International Boundary	Int.[a]
	Battle Creek Tributary Basin	
$11AB_{76}$	Battle Creek above Cypress Lake West Inflow Canal near West Plains, Saskatchewan	Int.[a]
$11AB_{27}$	Battle Creek at International Boundary	Int.[a]

Map Index	Stream and Location	Remarks
	Battle Creek Tributary Basin	
$11AB_{0.1}$	Woodpile Coulee near International Boundary	Int.[a]
$11AB_{0.3}$	East Branch of Battle Creek near International Boundary	Int.[a]
$11AB_{75}$	Lyons Coulee at International Boundary	Int.[a]
$11AB_{78}$	Cypress Lake West Inflow Canal	Int.[a]
$11AB_{77}$	Cypress Lake West Outflow Canal	Int.[a]
	Frenchman River Tributary Basin	
$11AC_{37}$	Cypress Lake Reservoir near Vidora, Saskatchewan	Int.R[a]
$11AC_{64}$	Belanger Creek Diversion to Cypress Lake	Int.[a]
$11AC_{60}$	Cypress Lake East Outflow Canal	Int.[a]
$11AC_{18}$	Frenchman River above East End Reservoir	Int.[a]
$11AC_{55}$	East End Reservoir at East End, Saskatchewan	Int.R[a]
$11AC_{52}$	East End Canal at East End, Saskatchewan	Int.[a]
$11AC_{1}$	Frenchman River below East End Reservoir	Int.[a]
$11AC_{63}$	Val Marie West Reservoir, near Val Marie, Saskatchewan	Int.R[a]
$11AC_{65}$	Val Marie West Gravity Canal	Int.[a]
$11AC_{56}$	Val Marie Reservoir near Val Marie, Saskatchewan	Int.R[a]
$11AC_{54}$	Val Marie Main Canal	Int.[a]
$11AC_{41}$	Frenchman River at International Boundary	Int.[a]
	Rock Creek Tributary Basin	
$11AE_{0.2}$	Rock Creek at International Boundary	Int.[a]
$11AE_{0.6}$	Rock Creek below Horse Creek near International Boundary	Int.[a]
$11AE_{0.3}$	Horse Creek near International Boundary	Int.[a]
$11AE_{0.4}$	McEachern Creek near International Boundary	Int.[a]

GAUGING STATIONS OPERATED INDEPENDENTLY
BY CANADA OR UNITED STATES

IN ST. MARY AND MILK RIVER DRAINAGE BASINS

- 1957 -

Map Index	Stream and Location	Remarks
	St. Mary River Basin	
	Grinnell Creek near Many Glacier, Montana	U.S.[c]
	St. Mary River near Babb, Montana	U.S.[c]
	St. Mary Lake near St. Mary, Montana	U.S.[c]
$5AE_{0.1}$	United States St. Mary Canal at Intake near Babb, Montana	U.S.[c]
$5AE_{6}$	St. Mary River near Lethbridge	Canada[c]
$5AE_{5}$	Rolph Creek near Kimball, Alberta	Canada[a]
$5AE_{2}$	Lee Creek at Cardston, Alberta	Canada[a]
$5AE_{25}$	St. Mary Reservoir near Spring Coulee, Alberta	Canada R[a]
$5AE_{26}$	Canadian St. Mary Canal near Spring Coulee, Alberta	Canada[a]
$5AF_{28}$	Canadian St. Mary Canal at Drop 1	Canada[c]
$5AE_{21}$	Magrath Irrigation District Canal near Spring Coulee, Alberta	Canada[a]
	Milk River Basin	
	Lodge Creek Tributary Basin	
$11AB_{82}$	Lodge Creek near Alberta Boundary	Canada[a]
$11AB_{9}$	Middle Creek near Alberta Boundary	Canada[a]
$11AB_{80}$	Middle Creek Reservoir	Canada R[a]
$11AB_{60}$	Spangler Ditch near Govenlock, Saskatchewan	Canada[a]
2	North Chinook Canal near Havre, Montana	U.S.[b]

Map Index	Stream and Location	Remarks
	Battle Creek Tributary Basin	
$11AB_{81}$	Battle Creek at Ranger Station	Canada[c]
$11AB_{85}$	Cypress Lake West Inflow Canal Drain	Canada[a]
$11AB_{84}$	Vidora Ditch near Consul, Saskatchewan	Canada[a]
$11AB_{58}$	Richardson Ditch near Consul, Saskatchewan	Canada[a]
$11AB_{44}$	McKinnon Ditch near Consul, Saskatchewan	Canada[a]
$11AB_{18}$	Stirling and Nash Ditch near Consul, Saskatchewan	Canada[a]
3	Matheson Canal near Chinook, Montana	U.S.[b]
	Frenchman River Tributary Basin	
$11AC_{51}$	Frenchman River below Val Marie, Saskatchewan	Canada[c]
$11AC_{66}$	Val Marie West Pumping Canal near Val Marie, Saskatchewan	Canada[a]
4	Frenchman Canal near Saco, Montana	U.S.[b]

Int. - International Gauging Station

Int.R - International Station on Reservoir

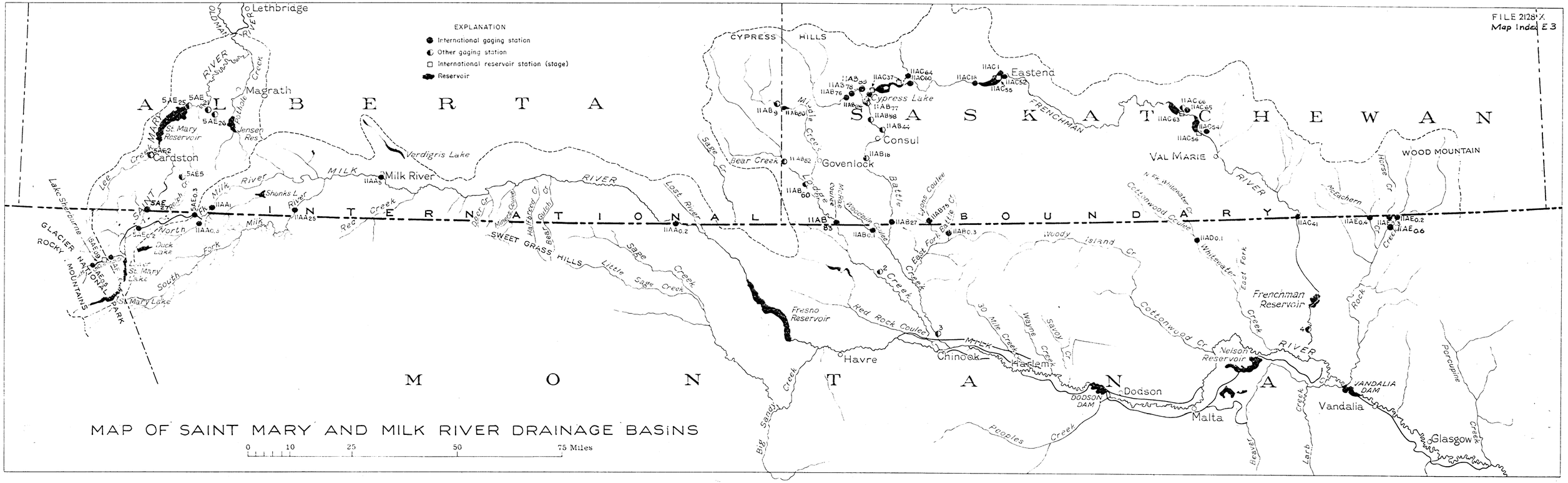
U.S. - Denotes operation by United States Geological Survey.

Canada - Denotes operation by Water Resources Branch, Canada.

a - Monthly and daily discharge data and stream measurements contained in Appendix.

b - Monthly Discharge data only tabulated in this report.

c - Data not included in this report or appendix.


FILE 2128-X
Map Index E3
EXPLANATION
International gaging station
Other gaging station
International reservoir station (stage)
Reservoir
A L B E R T A
S A S K A T C H E W A N
M O N T A N A
INTERNATIONAL BOUNDARY
Lethbridge
Magrath
Cardston
St. Mary Reservoir
Jensen Res.
Verdigris Lake
Milk River
Shanks L.
Duck Lake
Upper St. Mary Lake
St. Mary Lake
GLACIER NATIONAL PARK
ROCKY MOUNTAINS
Lake Sherburne
CYPRESS HILLS
Eastend
Cypress Lake
Consul
Govenlock
Bear Creek
Fresno Reservoir
Havre
Chinook
Harlem
Dodson
DODSON DAM
Malta
Nelson Reservoir
Frenchman Reservoir
VAL MARIE
WOOD MOUNTAIN
VANDALIA DAM
Vandalia
Glasgow
SWEET GRASS HILLS
MAP OF SAINT MARY AND MILK RIVER DRAINAGE BASINS
0 10 25 50 75 Miles

Report to the International Joint Commission on the division and use of the waters of the St. Mary and Milk Rivers...

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