

MEMORANDUM ON EFFECT OF ALBERTA DEVELOPMENTS  
ON SOUTH SASKATCHEWAN RIVER PROJECT

Prepared for the use of the Chairman,  
Prairie Provinces Water Board,  
by the Water Board staff.  
Regina, Saskatchewan,  
419 Post Office Building,  
March 6th, 1951.

GENERAL

This memorandum will answer the question raised by the Minister of Agriculture of Saskatchewan in his letter of May 4, 1949, to the Chairman of the Prairie Provinces Water Board, namely:

".....there may be conflict between plans for the use of the waters of the South Saskatchewan River in Saskatchewan and Alberta. Will your Board therefore report if there is conflict, and if so, how far this conflict be reconciled and by what means."

The flow of the South Saskatchewan River in Saskatchewan has been, and will be, affected by upstream diversions in:

(a) United States of America. By international treaty the U.S.A. has rights to a part of the flow of the St. Mary River. To date she has never taken the whole of her share; the balance of her share has been flowing downstream into Saskatchewan. There is no doubt that some day these waters will be retained and used in the U.S.A. The U.S.A. is now seeking rights to a portion of the flows of the Waterton and Belly Rivers. If this action is allowed, the river flow in Saskatchewan will be still further diminished.

(b) Alberta. There are both existing and proposed diversion works in Alberta which will affect the flow of the river. Some of these works will prove harmful, some beneficial to Saskatchewan.

(c) Saskatchewan. Certain projects, such as the Swift Current Irrigation Project, will decrease the available water supply for other projects downstream.

Saskatchewan's primary interest in the waters of the South Saskatchewan River stems from the proposed South Saskatchewan River Project. This project, as set forth in reports by the P.F.R.A., is a multipurpose project having the objective of:

- (a) irrigating 455,000 acres of land,
- (b) producing 325,000,000 k.w.h. annually of firm commercial energy, and an average of 100,000,000 k.w.h. annually of secondary commercial energy,
- (c) producing some 50,000,000 k.w.h. annually of firm pumping power,
- (d) improving the quality and quantity of water in the Qu'Appelle Valley in low water years,
- (e) improving the regimen of flow downstream from the reservoir both from the aspects of flood control and power potential.

It can be stated that there will be no conflict between the above objectives of the South Saskatchewan River Project and Alberta diversions, provided:

- (a) Alberta does not attempt to irrigate more than 1,710,000 acres of land \*
- (b) Alberta uses water from the Clearwater River (a tributary of the North Saskatchewan River) to assist in the development of the Red Deer Project. As this would be a very profitable diversion, it is unlikely Alberta would not do this.
- (c) that no lower series of flows occur on the South Saskatchewan River and its tributaries than have occurred naturally in the known past.

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\* - Acres actually irrigated in Alberta in:

1941 - 440,000 acres	1945 - 450,000 acres
1942 - 400,000	1946 - 455,000
1943 - 450,000	1947 - 450,000
1944 - 470,000	1948 - 440,000

FLOW AT ALBERTA-SASKATCHEWAN BOUNDARY

Water supply studies have been made of the effect of existing and proposed Alberta developments on the flow of the South Saskatchewan River at the Alberta-Saskatchewan Boundary.

Four different sets of conditions were assumed in Alberta and the resulting flows at the Boundary were found. The four assumptions were:

1. Natural flows - as if all the waters were allowed to flow naturally, undiminished in quantity and unchanged in time,

2. Recorded flows - the water that actually did flow past the Boundary.

3. After Alberta's request - it was assumed that those projects recommended by the Water Board on May 6, 1949, upon the request of Alberta, were fully developed.

4. After Alberta's request, Red Deer Irrigation and Clearwater Diversion - it was assumed that in addition to the above 'recommended' projects, Alberta had developed the Red Deer Irrigation Project (350,000 acres with the aid of the diverted Clearwater River) plus an additional 60,000 acres in small irrigation projects.

The resulting average monthly flows at the Boundary for the above conditions, for the period 1923-48, will be found in the four tables accompanying this report.

These tabulated flows have been processed to give flow-duration curves at the Boundary, see Figure A. These flow-duration curves show the flows exceeded for any desired percentage of the time covered by the record (e.g. a flow figure shown as occurring 80% of the time indicates that 80% of the time the river flow would exceed this figure while 20% of the time the river flow would be less than this figure).

An inspection of these flow duration curves (Figure A) indicate that the developments in Alberta:

- (a) will cause very little change in the flow available 50% of the time from that actually occurring in the past.
- (b) will decrease the high-water flows.

(e) will increase the low-water flows.

An examination of the tabulated flows at the Boundary gives the following average annual flows for the four conditions:

AVERAGE ANNUAL FLOWS AT BOUNDARY - IN ACRES-FEET

Condition	25 year average (1923-48)	Lowest 7yr average (1934-41)
Natural	6,966,000	5,300,000
Recorded	6,305,000	4,480,000
After Alta's request	5,000,000	3,442,000
After Alta's request & Red Deer Project, etc.	4,869,000	3,261,000

EFFECT ON SOUTH SASKATCHEWAN RIVER PROJECT

Reservoir studies have been made for this project using the following assumptions:

General Assumptions

Period of years investigated - 1923-48  
 Area irrigated in Swift Current Project = 21,000 acres  
 Area irrigated in this project = 455,000 acres  
 including land in Qu'Appelle Valley  
 Water required for gravity & pump irrigation = 740,000 ac.ft.  
 Qu'Appelle Diversion = 84,000 acre-feet  
 Water required annually for irrigation pumping =  
 305,000 - 450,000 acre-feet depending on reservoir elevation  
 Seepage loss @ 100 c.f.s. continuously = 72,000 acre-feet  
 Evaporation loss @ 24 inches from reservoir surface  
 Available reservoir storage = 4,000,000 acre-feet  
 Allowable reservoir drawdown = 1825 - 1785 = 40 feet  
 Turbine-generator efficiency = 80%

Distribution of commercial energy production by months:

January - 13.0%	July - 4.5%
February - 9.0	August - 7.0
March - 7.0	September - 8.0
April - 5.0	October - 11.0
May - 5.0	November - 12.0
June - 4.5	December - 14.0

Assumptions used for Alberta's development

- (1) Full development of Alberta's existing projects (after Alberta's request).
- (2) As above, plus development of some of Alberta's proposed projects (including Red Deer Project with Clearwater diversion). See Figure B for an interesting diagram of reservoir conditions for this condition.

Results

These studies indicate that with the above assumptions the only effect of Alberta's developments will be the effect on the firm energy production: irrigation in Saskatchewan will not be affected.

Thus, for condition (1) the firm annual energy production will be 350,000,000 k.w.h.; for condition (2) the firm production will be 325,000,000 k.w.h.; the average annual production of secondary energy remains the same at 100,000,000 k.w.h. as does the pumping energy requirements of 50,000,000 k.w.h. Adding the secondary energy to the firm production gives the average annual commercial energy production as 450,000,000 k.w.h. for condition (1), and 425,000,000 K.W.H. for condition (2).

CONCLUSIONS

Foreseeable developments in Alberta will never retard nor restrict irrigation developments in Saskatchewan; any conflict would only be with regard to power developments in Saskatchewan.

However, inasmuch as P.F.R.A.'s report to the Government only visualizes the South Saskatchewan River Project producing 425,000,000 k.w.h. of average annual energy (same as condition (2) - after Alberta's request and Red Deer Project, etc.), there should be no reason for conflict over the degree of power production unless Alberta irrigates more than 1,710,000 acres. \*

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\* Alberta irrigated in 1948 - 440,000 acres

Alberta's approved request from Water Board - 1,256,000 acres.

Total irrigable area in Alberta according to Mr. B. Russell -  
1,923,600 acres.

SOUTH SASKATCHEWAN RIVER AT ALBERTA-SASKATCHEWAN BOUNDARY  
RECORDED FLOW

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total Ac.
1911-12	7,530	5,278	2,871	1,838	2,384	2,545	10,081	17,615	23,467	35,005	18,734	13,880	8,570,000
1912-13	9,446	6,699	2,981	2,077	2,423	2,559	16,118	17,404	35,153	23,560	16,031	10,072	8,737,000
1913-14	7,533	5,727	3,487	2,772	1,861	4,551	7,225	16,596	23,851	17,167	8,320	6,146	6,374,000
1914-15	9,525	6,586	2,621	2,530	2,227	7,352	7,548	24,998	49,024	55,814	26,973	13,413	12,643,000
1915-16	10,741	6,027	2,948	2,066	6,300	7,965	10,879	15,057	62,522	49,132	25,429	22,941	13,422,000
1916-17	11,698	7,799	4,287	3,031	2,670	3,600	14,745	35,525	54,614	24,880	10,278	7,674	10,938,000
1917-18	6,369	4,319	4,287	3,504	2,803	8,964	9,371	12,338	24,467	11,207	8,297	5,848	5,984,000
1918-19	4,994	3,237	2,303	2,236	1,913	1,964	8,422	15,565	16,439	7,924	10,416	5,204	4,879,000
1919-20	2,907	2,345	2,226	1,978	2,446	5,224	16,307	33,130	24,602	28,787	10,776	4,621	4,821,000
1920-21	4,775	3,225	2,341	2,149	2,412	3,175	10,846	17,782	25,704	12,747	6,911	3,154	5,755,000
1921-22	3,170	2,813	2,254	1,959	1,435	2,218	7,399	16,549	24,960	11,834	7,597	4,852	5,264,000
1922-23	3,296	2,474	1,577	1,707	1,326	2,183	5,337	11,857	65,555	26,300	14,075	7,780	8,653,000
1923-24	5,698	3,604	2,160	1,601	2,416	2,592	4,553	14,158	22,790	15,187	13,453	5,876	5,703,000
1924-25	4,167	3,474	2,502	2,514	2,510	6,943	18,351	18,840	25,689	13,150	9,841	8,071	7,010,000
1925-26	9,895	5,400	3,817	2,426	2,531	8,323	16,361	7,299	11,195	10,570	5,131	24,093	5,981,000
1926-27	15,462	7,240	4,453	3,297	2,807	5,150	16,361	25,034	51,480	29,754	18,804	19,975	12,081,000
1927-28	11,821	6,980	4,431	7,811	4,529	14,036	11,562	21,508	44,610	39,847	11,249	7,556	11,275,000
1928-29	7,388	4,649	2,302	2,139	1,997	4,959	4,757	16,418	38,930	8,091	4,300	2,841	5,960,000
1929-30	1,825	2,219	2,239	1,635	4,591	4,850	9,492	14,364	22,173	14,380	5,590	3,402	5,233,000
1930-31	3,721	2,764	2,648	2,053	1,938	2,292	3,369	6,272	13,950	9,800	3,860	5,707	3,409,000
1931-32	3,404	2,157	1,720	1,600	1,926	3,410	6,927	16,409	43,104	13,307	5,706	3,637	6,038,000
1932-33	3,749	3,400	2,570	2,210	1,986	3,070	7,907	25,649	27,454	14,077	4,056	3,607	5,978,000
1933-34	2,929	5,730	3,300	3,640	3,906	4,210	11,997	22,089	26,604	8,517	3,586	3,220	5,213,000
1934-35	3,599	5,080	2,600	2,400	3,675	3,180	7,435	10,825	21,362	15,052	7,900	3,885	4,162,000
1935-36	2,930	2,279	1,796	1,762	1,781	4,494	14,610	13,448	16,712	4,220	3,040	1,885	3,574,000
1936-37	1,218	1,790	1,043	1,120	1,240	2,751	5,454	6,315	27,989	17,600	6,480	3,135	4,600,000
1937-38	3,270	3,750	2,480	2,310	1,723	4,025	8,856	18,168	23,568	13,760	4,555	6,210	4,456,000
1938-39	4,210	2,800	2,090	1,610	1,620	4,193	6,001	8,651	11,629	6,810	4,290	4,870	3,193,000
1939-40	2,885	3,360	2,260	1,640	1,700	3,936	13,098	15,597	9,000	5,365	4,290	10,360	7,030,000
1940-41	5,170	3,560	2,620	2,015	1,800	4,928	5,412	4,563	35,582	27,230	13,750	3,220	8,007,000
1941-42	7,500	4,060	3,155	2,620	3,136	5,916	25,340	21,884	23,152	19,740	6,820	4,070	3,631,000
1942-43	2,440	2,600	2,480	2,300	2,030	2,518	5,128	3,801	15,421	7,890	9,380	5,230	5,465,000
1943-44	2,770	2,900	2,480	2,235	2,100	4,263	4,506	11,813	30,441	16,570	5,160	7,120	6,159,000
1944-45	3,560	3,760	3,560	3,410	2,996	6,061	8,806	12,191	29,061	13,930	4,950	8,250	8,090,000
1945-46	4,150	4,590	4,350	3,580	4,638	13,131	17,312	25,622	27,005	13,860	6,430	4,610	12,853,000
1946-47	2,530	6,150	3,920	3,285	2,910	5,066	29,008	56,836	57,922	17,450	13,660	263,450	257,056,000
1947-48	11,130	215,555	100,834	90,795	94,522	179,724	384,612	643,949	1,108,647	668,919	345,658	7,120	6,947,000
TOTAL	5,826	4,164	2,725	2,454	2,555	4,857	10,395	17,404	29,963	18,079	9,342	7,120	6,947,000
AVERAGE													→ 6,948,000

TABLE 1



SOUTH SASK. RIVER AT THE ALBERTA-SASKATCHEWAN BOUNDARY - RECONSTRUCTED NATURAL FLOW (Sec. Ft.)

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total Ac. Ft.
1911-12	7,358	5,111	2,776	1,752	2,313	2,480	10,018	16,998	23,080	34,869	18,883	14,021	8,475,000
1912-13	9,485	6,453	2,758	1,865	2,310	2,302	15,827	17,312	33,685	23,456	16,158	10,411	8,588,000
1913-14	7,621	5,417	3,041	2,660	1,796	4,477	7,218	16,513	23,722	17,029	8,374	6,389	6,315,000
1914-15	9,582	6,218	2,469	2,417	2,004	7,066	7,506	24,937	48,865	55,364	27,139	13,795	12,587,000
1915-16	11,046	5,918	2,917	1,922	6,022	7,388	10,722	15,032	61,310	48,000	25,409	22,992	13,222,000
1916-17	7,482	3,949	3,949	2,728	2,505	3,514	14,697	35,442	53,447	24,938	11,142	8,127	10,838,000
1917-18	6,511	4,360	1,372	2,918	2,580	8,899	9,325	12,271	24,781	12,701	9,383	6,790	6,160,000
1918-19	5,421	3,317	2,009	1,836	1,756	1,899	8,306	15,967	18,597	10,384	11,809	6,114	5,292,000
1919-20	3,851	2,048	1,982	1,702	2,252	5,093	16,185	32,774	25,346	29,593	12,315	5,952	8,433,000
1920-21	5,339	3,028	2,113	1,915	2,229	2,900	11,039	17,593	26,981	15,463	8,945	4,704	5,183,000
1921-22	3,828	2,624	1,947	1,796	1,256	2,088	7,314	16,844	26,183	14,298	9,448	6,125	6,673,000
1922-23	3,807	2,302	1,278	1,455	1,149	2,071	5,234	13,011	65,601	27,427	15,468	8,631	8,896,000
1923-24	6,072	3,476	1,993	1,403	2,347	4,403	4,403	15,682	25,002	17,446	15,587	7,381	7,376,000
1924-25	4,755	3,315	2,273	2,299	2,145	6,689	18,108	19,389	26,833	15,345	11,476	9,300	6,241,000
1925-26	9,811	5,298	3,703	2,279	2,308	8,082	8,700	8,954	26,833	19,163	7,281	24,691	6,548,000
1926-27	15,447	7,006	4,703	2,961	2,544	4,907	16,178	24,169	14,155	39,365	12,330	8,756	11,387,000
1927-28	11,878	6,503	4,185	7,479	4,262	13,638	11,360	21,430	50,586	29,771	19,800	20,384	11,982,000
1928-29	7,475	4,400	2,121	1,949	1,750	4,658	4,769	18,177	39,294	10,813	6,347	4,774	6,434,000
1929-30	3,503	2,258	2,252	1,488	1,750	4,195	10,157	15,252	24,532	17,700	8,219	5,374	5,998,000
1930-31	4,355	2,533	2,114	1,994	1,784	1,729	3,066	9,389	17,353	12,712	6,313	5,683	4,177,000
1931-32	4,352	2,044	1,720	1,280	1,765	3,015	6,850	18,906	43,824	16,314	8,108	7,142	6,965,000
1932-33	4,402	3,377	2,408	2,047	1,814	2,838	7,620	25,822	30,216	17,547	7,037	5,599	6,705,000
1933-34	3,703	5,170	3,058	3,360	3,445	3,862	11,622	23,769	28,862	11,749	6,143	4,521	6,598,000
1934-35	4,170	5,014	2,237	2,241	3,287	2,656	7,182	11,839	19,263	19,263	11,007	5,526	6,025,000
1935-36	3,528	2,117	1,454	1,272	939	4,372	14,962	15,070	25,524	7,923	5,654	4,190	4,896,000
1936-37	2,120	1,550	470	442	930	2,021	5,416	9,211	24,813	12,798	7,956	5,419	4,430,000
1937-38	4,120	3,562	2,405	2,101	1,360	3,809	9,155	19,345	31,214	21,257	9,209	7,252	6,948,000
1938-39	4,935	2,719	1,677	1,329	1,996	3,931	5,949	11,066	26,651	17,264	6,783	5,001	5,345,000
1939-40	3,949	3,463	1,774	1,191	1,351	3,629	13,146	17,138	15,896	10,686	6,921	8,180	5,283,000
1940-41	3,322	3,322	2,175	1,431	1,455	4,424	5,279	7,520	13,027	9,599	7,176	7,532	4,175,000
1941-42	6,272	3,567	2,358	1,917	1,351	2,188	5,691	24,474	38,275	31,330	17,077	12,928	8,937,000
1942-43	8,323	3,759	2,286	1,650	2,506	5,038	24,982	12,786	26,518	24,756	10,481	5,685	7,782,000
1943-44	3,447	1,909	1,699	1,462	1,253	1,637	4,309	12,782	19,798	12,109	12,790	6,591	4,523,000
1944-45	3,665	2,375	1,617	1,462	1,253	1,637	4,309	14,712	33,317	20,267	8,402	8,112	6,209,000
1945-46	7,289	3,321	2,855	2,479	2,189	3,623	3,839	14,708	32,940	17,793	8,385	10,091	7,029,000
1946-47	6,987	3,637	3,476	2,675	3,820	5,979	16,208	27,634	30,224	18,631	10,162	10,375	8,848,000
1947-48	12,264	6,181	3,219	2,657	1,936	4,002	28,051	56,006	60,679	21,488	16,374	6,868	13,319,000
TOTAL	237,748	146,154	88,547	77,734	81,397	165,828	378,651	684,924	1,170,036	761,011	421,491	321,406	274,808,000
AVERAGE	6,426	3,950	2,393	2,101	2,200	4,482	10,234	18,511	31,810	20,568	11,392	8,687	7,427,000

TABLE 21

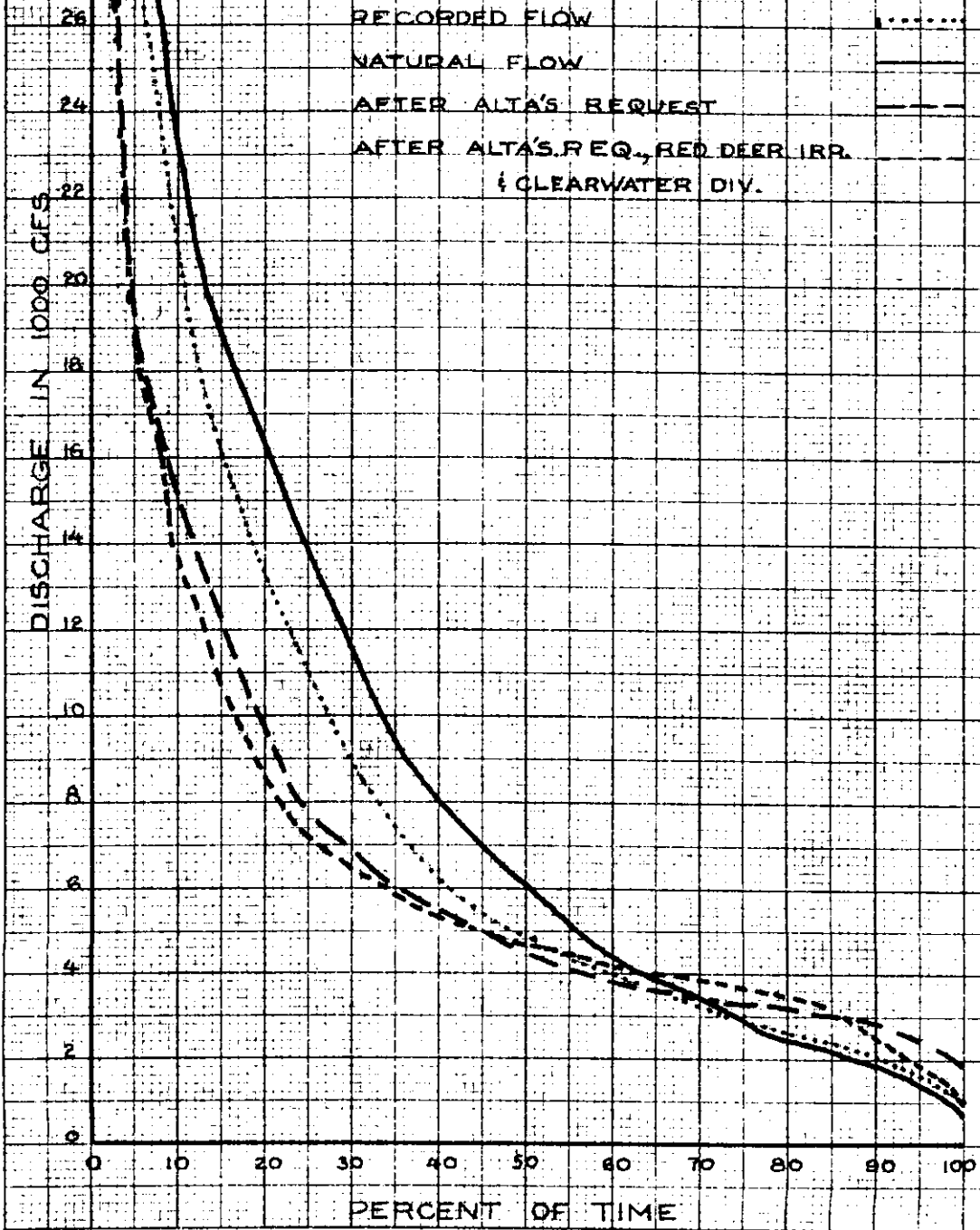
SOUTH SASKATCHEWAN RIVER AT THE ALBERTA-SASKATCHEWAN BOUNDARY AFTER ALBERTA'S 1949 REQUEST (Sec. Ft.)  
Condition #

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total Ac.Ft.
1923	-	-	-	2,792	2,438	3,560	4,282	6,392	51,060	18,171	10,874	6,446	6,381,000
1923-24	5,000	4,202	3,212	2,952	3,438	3,563	2,462	7,652	13,901	8,261	9,689	5,151	4,208,000
1924-25	3,342	3,849	3,417	3,206	3,536	7,823	15,612	12,730	14,914	7,698	7,228	7,238	5,467,000
1925-26	8,470	5,330	4,311	3,549	3,529	9,239	7,260	3,282	6,264	6,663	4,811	19,600	4,964,000
1926-27	12,895	6,936	4,956	4,020	3,915	5,938	14,192	17,626	38,898	21,317	15,367	17,581	9,885,000
1927-28	10,372	6,218	4,925	7,970	5,312	13,433	9,516	13,986	36,752	30,273	8,097	5,982	9,260,000
1928-29	5,798	5,122	3,468	3,909	3,668	6,205	3,809	11,558	24,293	3,079	2,541	2,559	4,581,000
1929-30	3,173	3,396	3,577	3,104	5,976	5,635	7,626	8,622	10,831	7,115	3,009	3,144	3,924,000
1930-31	3,802	3,710	3,731	3,223	3,019	3,099	2,385	2,520	5,830	4,994	2,209	2,834	2,496,000
1931-32	4,101	3,030	2,829	2,798	2,746	3,906	5,838	11,421	29,487	8,538	3,113	5,202	5,007,000
1932-33	3,774	4,131	3,654	3,278	3,216	4,132	6,169	19,340	16,596	6,702	2,109	2,469	4,569,000
1933-34	2,220	5,378	4,096	4,281	4,631	5,019	8,498	15,567	17,161	4,260	1,868	2,271	4,546,000
1934-35	3,991	5,502	3,515	3,536	4,488	4,004	5,976	5,845	12,509	8,405	5,143	3,304	3,991,000
1935-36	3,216	3,297	2,773	2,363	2,678	5,744	13,524	6,521	7,685	2,143	1,906	1,903	3,242,000
1936-37	1,834	2,577	1,648	1,844	2,212	3,224	4,123	2,659	11,624	3,029	2,215	2,787	2,392,000
1937-38	3,325	4,088	3,733	3,485	2,821	5,159	7,645	11,469	16,798	10,917	4,303	4,616	4,736,000
1938-39	4,287	3,850	3,325	2,862	2,576	5,090	4,458	3,824	14,826	7,448	2,605	3,113	3,515,000
1939-40	3,143	3,936	2,931	2,757	2,725	4,793	12,132	8,946	5,076	3,666	3,108	4,773	3,503,000
1940-41	5,035	4,353	3,421	2,846	3,058	5,558	4,358	2,028	3,656	3,341	2,564	4,376	2,715,000
1941-42	4,833	3,856	2,965	2,793	2,386	3,055	3,896	17,111	26,732	20,200	12,328	9,848	6,656,000
1942-43	7,022	4,630	3,471	3,097	3,848	6,457	21,877	6,407	15,079	12,907	4,830	2,636	5,562,000
1943-44	2,977	3,045	3,072	2,962	2,849	3,114	3,313	2,032	9,063	5,607	7,392	3,553	2,963,000
1944-45	2,628	3,138	3,015	2,732	2,797	4,888	3,237	7,496	19,679	10,168	3,795	5,055	4,141,000
1945-46	5,955	3,740	4,070	3,929	3,442	7,392	6,717	6,398	20,179	9,409	3,368	7,530	4,954,000
1946-47	5,568	4,533	4,573	4,092	4,980	13,475	14,192	17,790	17,506	10,730	5,599	7,357	6,672,000
1947-48	9,937	6,376	4,200	3,742	3,323	5,602	26,536	48,569	49,178	13,207	11,272	4,221	11,262,000
TOTAL	126,698	108,423	88,788	85,330	87,169	145,547	215,351	271,399	444,547	230,083	130,869	139,103	125,209,000
AVERAGE	5,068	4,337	3,552	3,413	3,487	5,822	8,614	10,856	17,792	9,203	5,235	5,564	5,008,000

SOUTH SASKATCHEWAN RIVER AT THE BOUNDARY  
AFTER ALBERTA'S REQUEST, RED DEER AND SMALL IRRIGATION (With Clearwater R. Diversion)

Year	Condition B												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total Ac.Ft
1923				3,650	3,305	4,401	3,568	4,894	49,529	17,921	10,934	6,339	6,290,000
1923-24	5,122	4,671	3,817	3,646	4,072	3,962	1,259	7,497	13,506	7,586	9,531	4,558	4,193,000
1924-25	3,603	4,363	4,095	3,908	4,250	8,445	13,527	11,692	14,614	6,767	7,330	7,750	5,450,000
1925-26	9,242	6,005	4,676	4,064	4,026	9,280	7,285	2,100	4,939	5,673	3,771	20,080	4,889,000
1926-27	13,894	7,793	5,352	4,622	4,473	6,365	13,836	16,878	39,008	21,417	15,381	17,747	10,072,000
1927-28	10,800	6,594	5,425	8,429	5,738	13,203	9,632	12,739	36,512	30,023	7,264	5,211	9,120,000
1928-29	5,942	5,620	4,060	4,614	4,410	6,712	3,041	8,894	24,053	1,859	1,621	1,831	4,373,000
1929-30	3,723	4,025	4,325	3,879	6,438	6,014	5,850	6,946	7,830	6,080	1,982	2,288	3,573,000
1930-31	4,278	4,288	4,482	4,048	3,811	3,831	2,023	1,495	3,416	2,144	2,304	2,064	2,224,000
1931-32	4,601	3,630	3,329	3,443	3,486	4,686	5,094	8,303	29,297	7,472	2,304	4,560	4,833,000
1932-33	4,025	4,525	4,277	3,913	3,933	4,819	4,265	18,552	16,120	5,667	1,105	1,804	4,416,000
1933-34	2,820	6,228	4,866	4,941	5,321	4,699	6,496	14,800	16,406	8,155	6,733	2,486	4,327,000
1934-35	4,491	6,102	4,165	4,336	5,288	4,794	5,338	4,463	9,553	2,896	1,033	1,601	3,977,000
1935-36	3,668	3,932	3,547	3,114	3,491	6,510	10,696	5,855	7,290	1,033	1,016	1,313	3,104,000
1936-37	2,465	3,193	2,552	2,738	3,109	3,982	3,533	1,697	9,168	1,439	1,005	1,857	2,205,000
1937-38	3,437	4,587	4,452	4,201	3,645	5,734	6,891	9,394	13,076	9,221	3,461	4,527	4,386,000
1938-39	4,679	4,525	4,115	3,647	3,389	5,549	3,822	2,906	12,001	6,485	1,529	2,367	3,317,000
1939-40	3,533	4,326	3,578	3,574	3,539	5,483	9,582	8,203	3,894	2,456	2,148	3,783	3,277,000
1940-41	5,495	4,977	4,120	3,619	3,809	5,987	3,862	1,600	3,447	2,031	1,344	3,206	2,562,000
1941-42	5,038	4,415	3,702	3,702	3,221	3,892	3,672	15,193	23,041	19,866	11,728	9,004	6,441,000
1942-43	6,712	4,919	3,956	3,815	4,548	6,755	21,050	5,208	14,639	12,142	3,853	1,782	5,388,000
1943-44	3,259	3,647	3,806	3,740	3,636	3,585	2,349	6,251	7,164	5,166	7,452	3,167	3,857,000
1944-45	2,813	3,523	3,659	3,431	4,086	5,467	6,365	6,192	19,401	8,421	3,160	4,624	4,011,000
1945-46	6,351	4,192	4,520	4,443	4,024	7,032	6,670	5,389	19,989	10,748	2,415	6,909	4,862,000
1946-47	5,588	5,049	5,155	4,649	5,639	13,385	13,770	17,023	17,228	10,010	4,676	6,706	6,576,000
1947-48	10,005	6,977	4,530	4,297	3,983	6,261	25,338	48,633	48,938	12,496	10,736	3,470	11,233,000
TOTAL	135,584	122,106	104,581	102,725	104,825	156,432	191,246	241,921	413,530	205,253	113,382	124,695	121,729,000
AVERAGE	5,423	4,884	4,183	4,109	4,193	6,257	7,650	9,677	16,541	8,210	4,535	4,988	4,869,000

# FLOW DURATION CURVES OF SOUTH SASKATCHEWAN RIVER AT THE ALTA.-SASK. BOUNDARY



MADE IN U.S.A.

