

portion of the river. From Cross Lake to Lake Winnipeg a series of rapids occur comprising the Cross Lake rapids, Bed Rock Rapids and Grand Rapids.

Nature of the River and Banks.—In the vicinity of Le Pas, the banks range from 15 to 25 feet in height, but they become gradually lower as Cedar Lake is approached. The shores of this latter lake, as also the banks in the stretch of river to Cross Lake are rocky. From Cross Lake to the mouth of the river outcroppings of limestone occur at the water's edge. At Cross Lake Rapids this outcrop reaches a height of from 2 to 6 feet. In the vicinity of Red Rock Rapids the right bank is composed of limestone of some 6 feet in height, while the left shows no rock outcrops, being composed of clay and of some 12 feet in height. From Red Rock Rapids to Grand Rapids the banks, which are of clay, gradually become higher. At the latter rapids limestone is again encountered, rising in some places 30 feet above river level. A high ridge of lightly colored boulder clay overlying limestone rises to a height of some 60 feet about the mid point of Grand Rapids. This ridge which forms the barrier between Cedar Lake and Lake Winnipegosis crosses the Saskatchewan about three miles above the mouth. Near the foot of Grand Rapids a gully, which was probably as one time an overflow channel, sweeps inland from the left bank and returns to the main river a mile further down.

The river in Manitoba has an average width of about 1,000 feet; a minimum width of approximately 500 feet occurs in Grand Rapids, widening to 2,400 feet below the rapids. From the Manitoba boundary to Cedar Lake the river has a mud and gravel bottom with the occurrence of shifting bars. In the reaches below this section the bed of the river at various rapids is composed of limestone, while many beds of boulders occur in the intervening space.

A valuable timber growth occurs a slight distance above Le Pas, but from there to Cedar Lake the growth is stunted; and while a dense growth occurs around both Cedar and Cross Lakes, yet the timber occurring below this is largely of second growth.

High water usually comes during the months of July and August, while low water occurs in the winter months, the river reaching its lowest stage about the month of March. At Le Pas the range between these two periods is ordinarily some 15 feet, while at Grand Rapids the range is gradually lessened, being ordinarily from 4 to 5 feet with an extreme of some 6 feet. During the spring break-up the field ice of Lake Winnipeg occasionally becomes jammed at the mouth of the river, damming the outlet and causing a rise at the lake of from 12 to 15 feet.

The Saskatchewan is navigable above Grand Rapids, the Hudson's Bay Co. having at one period run steamers as far upstream as Edmonton. The river at present is navigated by gasoline launches from Le Pas to Cedar Lake. It is accessible by railroad at Le Pas and also by steamer at the mouth.

With the exception of Le Pas, no settlements of any size occur in the lower reaches of the river. A Hudson's Bay post is situated at Cedar Lake and a small settlement occurs at Grand Rapids.

Surveys of the River.—In 1884, Dr. Otto Klotz made a traverse of the river. The late R. E. Young made a survey of the settlement in the year 1903 and continued his traverse to the head of Grand Rapids, obtaining at the same time a profile of the portage. In 1909 a reconnaissance survey of the river was made from Le Pas to Lake Winnipeg by E. A. Forward, of the Public Works Department. The investigations made by the Water

Power Branch of the Department of the Interior comprise a reconnaissance power survey by the late William Ogilvie in the year 1911, and in the following year a detailed survey of Grand Rapids and vicinity from Lake Winnipeg to Cross Lake. This latter survey was carried out by E. B. Patterson in charge of a field party of the Manitoba Power Survey. At the same time, a gauging station was established at Grand Rapids and discharge measurements were then and have since been obtained at this station.

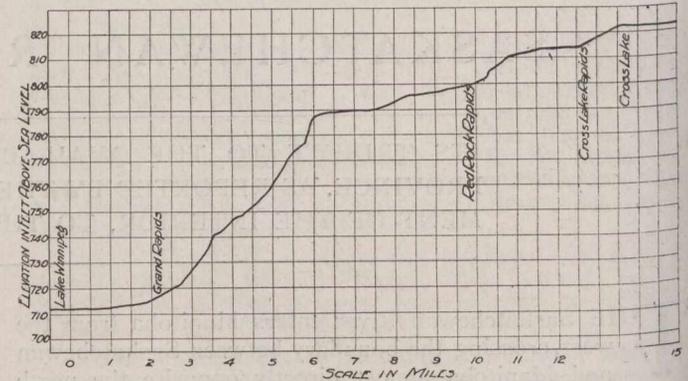


Fig. 2.—Profile of Saskatchewan River from Lake Winnipeg to Cross Lake.

Run-off.—No complete records are available for the precipitation in either the extreme western or eastern portion of the drainage. The following table, obtained from the meteorological records of Canada, gives the precipitation at various points throughout the central portion of the drainage, together with some few records of precipitation in the Rocky Mountains:—

Length of Record.

Station.	Period.	Beginning.	Depth, in inches.
Prince Albert	9 years	1903	17.13
Saskatoon	9 "	1904	14.45
McLeod	22 "	1884	12.58
Calgary	27 "	1885	15.17
Edmonton	28 "	1883	16.43
Banff	19 "	1891	20.3
Fort Dunvegan	4 "	1905	11.5

Float discharge measurements were made in the year 1909 by E. A. Forward at Le Pas, and also at Grand Rapids. This was followed by measurement made by the late William Ogilvie in the year 1911 at Grand Rapids. On August 8th, 1912, a gauging station was established at Grand Rapids by the Manitoba Hydrographic Survey, and on October 21st of the same year, a second station was established at Le Pas. It is estimated that for the year 1913, a low flow of 5,000 second-feet occurred during the month of February at Le Pas, and while several lakes and a great area of low-lying, swampy land occurs between this point and Grand Rapids which should give some regulation of the flow at the latter point, yet it has been assumed that a minimum flow of 5,000 second-feet also occurred at Grand Rapids. During July of 1913 a flood discharge of approximately 64,000 second-feet was recorded at Le Pas.

Storage Possibilities.—Three lakes are situated in the lower portion of the river system immediately above Grand Rapids; through two of these lakes—Cedar and Cross Lakes—the river flows, while Moose Lake is a tributary to the north. The combined area of these three lakes is estimated to be 970 square miles, being