

in the design of all structures for hydro-electric purposes.

The fisheries are also important, both from the commercial and sporting aspect, and it is absolutely essential that adequate fishways should be provided at all structures placed in the rivers.

**Climate and Precipitation.**—As a rule, severe winter conditions exist for several months in the year, particularly in the interior of the province, with an abundance of snow. Ice conditions of all kinds are, therefore, quite severe and excessive floods in the spring months are to be expected.

Precipitation is not excessive, and probably for the greater part of the interior of the province does not exceed 35 inches per year as an average.

**River Systems.**—The outstanding features of the province from a water-power standpoint can best be understood from a discussion of a few of the more important rivers.

**The St. John River.**—This river and the basin it drains is one of the outstanding features of the Maritime Provinces. By far the largest river in this part of the Dominion or the United States, it has a total drainage area of 26,000 square miles and a total length of about 450 miles. It is navigable for craft of commercial size from St. John to Grand Falls, a distance of over 200 miles; for 70 miles it forms the boundary between New Brunswick in Canada and the State of Maine in the United States, and for the first 90 miles of its course lies wholly within the State of Maine. Its broad valley, extending through the province for some 280 miles, with an average width of 100 miles, contains about two-thirds of the total population of the province, and offers excellent opportunities for agriculture. The river itself throughout this distance is a main thoroughfare for floating timber.

From the Reversible Falls at St. John, an unique phenomenon caused by a variation in the tide of about 30 feet at this point, to Fredericton, a distance of 50 miles, the valley is well wooded and sparsely settled. The lower part is quite rugged, while above that much flat intervalle land occurs. The more important part of the valley lies above Fredericton, where rolling uplands and wide, cultivated valleys occur. Above Grand Falls and around the headwaters of all tributary streams the country is thickly wooded.

The only natural water-power site on this river lying wholly within New Brunswick, and, indeed, the most outstanding water-power in all the Maritime Provinces, is at Grand Falls. This site is situated in the north-west corner of the province, not far from the Maine border, and about 200 miles from St. John, the main centre of population and industry. A direct drop of 74 feet occurs at this point, while it is possible to obtain a working head of 130 to 140 feet. The total tributary drainage area is 5,280 square miles, with considerable storage available.

It is evident that from the standpoint of magnitude and natural advantages this site compares very favorably with many other sites in Canada, either developed or proposed.

A number of other sites on the river, notably the Pokiok site and Meductic Falls, have been considered from time to time, but they offer few natural advantages. Several more promising sites exist on the upper waters of the river in the State of Maine, as well as one or two international sites.

The Tobique, one of the larger tributaries of the St. John, with a drainage area of 1,728 square miles, flows near its mouth through a restricted, gorge-like channel, which offers opportunities for creating an artificial head.

The Aroostook, another, and the largest tributary of the St. John, lies almost wholly in the State of Maine, though one of the larger power sites of the Province of New Brunswick exists on this river just over the Canadian boundary. Practically the whole of the drainage basin of the river (2,280 square miles) is tributary to this site, where a head of 77 feet is available, and which is partially developed at the present time by the Maine and New Brunswick Electric Power Company. Practically no storage is available.

A considerable amount of valuable run-off data is available for this river, as well as some of its tributaries, and all such data to the end of 1911 may be found in the 1911 report of the Commission of Conservation, Canada, on the "Water Powers of Canada." Data since that time are published in the Water Resources papers of the United States Geological Survey, part of which information is obtained from private parties interested at Grand Falls.

**The St. Croix River.**—This river system forms about one-half of the boundary between the Province of New Brunswick and the State of Maine, and is entirely an international stream. Its total drainage area above tide-water is 1,470 square miles, and it has a lake area of about 160 square miles.

From the standpoint of size, natural regularity of flow, with possibilities of further artificial regulation on its extensive lake system and facilities for development, it is one of the most important power rivers in this district. Considerable development on it has already taken place, most of which, however, is on the American side. The St. Croix Paper Company, a United States corporation, has a plant at Woodland with about 13,500 horse-power installed, and another at Grand Falls, where 8,000 horse-power is installed, with provision for the installation of another 4,000 horse-power. Existing or proposed developments are generally of a low-head type, taking advantage of low falls or rapids. At Woodland and Grand Falls, for example, the operating heads are 47 feet and 49 feet, respectively, while a number of other sites exist with possible heads from 8 to 40 feet.

Considerable information is available in connection with this river, due to the investigations of the International Joint Commission dealing with diversions for power purposes and a complete power report by F. A. Roper, Major Corps of Engineers, United States Army, and William J. Stewart, Department Naval Service, Canada, is available in the 1915 Report of the Maine Public Utilities Commission, Volume 2, recently issued. The United States Geological Survey publish run-off data for the river from year to year, as also the State of Maine Public Utilities Commission.

**Nepisquit River.**—This river offers the only favorable opportunities for power development of commercial magnitude in the eastern part of New Brunswick. At Grand Falls, on this river, there is a tributary drainage area of 644 square miles, with an available head of about 125 feet, most of which is concentrated in the falls itself.

A number of rapids with high, rocky banks exist in the lower reaches of the river, where heads from 25 to 60 feet might be concentrated by suitable dams.

It is worthy of note that a large deposit of iron ore exists in the immediate vicinity of Grand Falls. An