

## APPENDIX G

### WATER RESOURCES IN CANADA <sup>1/</sup>

Water resources in the North Pacific Planning area fall under two jurisdictions, namely, that of the Dominion of Canada, and the Province of British Columbia. The Dominion, through the Dominion Water and Power Bureau of the Department of Mines and Resources, administers water resources in the Yukon and the Northwest Territories, while British Columbia administers these resources in that part of the province within the North Pacific Planning area. A co-operative agreement of twenty years standing between the Dominion and the Province in regard to the development of water resources ensures full co-operation between the Federal and Provincial Governments on all water matters.

The water resources of the North Pacific Planning area are, of course, distributed over a tremendous area, and as would be expected their development will be shaped by the general topographical features that exist. As one travels towards the Arctic the land areas flatten out and near the northern coast become vast expanses of tundra and flat coastal plains. As a result the rivers flowing to the north have increasingly low gradients and banks in their northerly stretches. As a consequence there are no water power sites or storage sites on those sections of the rivers where maximum flows are reached and power sites are generally in the upper reaches where topography is more marked but where the stream flow is comparatively small. This fact places an emphasis on the importance of storage reservoirs.

On the other hand there are fortunately rivers in the northwest with sections of rapids or fast water and which combined with storage possibilities will enable some general plan of water power development to be visualized.

Rivers flowing to the West through the mountainous sections of British Columbia have favourable power possibilities. There are also many sites in the vicinity of the Pacific Coast where blocks of power ranging from 1,000 h.p. to 5,000 h.p. permit of economic development.

Reliable estimates of power available in the North Pacific area can only be based on stream flow records and storage site investigations and these have to date been very limited.

However, certain information is available which will give some idea of the amount of power that is to be further investigated.

In the Mackenzie River Basin of the Northwest Territories there is approximately 400,000 h.p. at 80 per cent efficiency on the basis of ordinary minimum flow. This information is based on reconnaissance power surveys made on several rivers of the Mackenzie Drainage area.

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<sup>1/</sup> Resume of a verbal report made by J. M. Wardle, Director, Surveys and Engineering Branch, Canadian Department of Mines and Resources.

In the Yukon Territory there is a potential of 13,500 h.p. at ordinary minimum flow. Over a six months period 36,500 h.p. might be developed.

On the Queen Charlotte Islands power sites on five rivers will give some 11,800 h.p. at minimum flow.

In the mainland of Northern British Columbia there are several power sites, including that on the Peace River west of Fort St. John with a potential minimum flow output of 160,000 h.p. The Nation River is promising from the power standpoint with a potential of 79,600 h.p.

The Skeena River Basin affords power sites totalling 315,800 h.p. Of fifteen rivers in this basin where power sites exist, the Bulkley River has a potential output of 220,000 h.p. Numerous small rivers flowing westerly into the Pacific have power sites of varying capacity with a total of 231,000 h.p. at minimum flow.

The upper Fraser River Basin within the North Pacific area affords a great block of power, totalling some 1,637,000 h.p. at minimum flow. Two great diversion projects with potential developments of 764,000 h.p. and 698,000 h.p. make up the greater part of this total.

On the Nass River Basin some 104,500 h.p. could be developed, while coastal stations north of the Nass River would afford small blocks of power totalling some 4,000 h.p. at minimum flow.

All the sites referred to will not be economically feasible. This will depend upon the development of natural resources within reach of the power sites and the amount of power required. Some of the sites will not permit any small initial development.

The amount of potential power outlined for ordinary minimum flow totals some 1/ 2,957,000 h.p. Of this tremendous amount the installed h.p. capacity in Northern British Columbia is 52,400; in the Yukon Territory 15,000; and in the Mackenzie River Basin 4,700. It is obvious that the power possibilities of the Canadian Northwest have hardly been touched and that ample hydro electric power is available there for the development of the country's resources.

As mentioned, flow records are the foundation of efficient power development, and we in Canada have a great problem in regard to hydrometric surveys and investigations. The North Pacific Planning area is so great that it would take many years to cover lake and stream possibilities. It is consequently necessary to decide which sites should be first investigated. It is proposed to make selections on the basis of where development of

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1/ At the present time hydro electric installations in Canada total 10,000,000 h.p., with a total estimated potential capacity of 43,700,000 h.p.

natural resources might take place. The first surveys and investigations will be made in those areas where information indicates natural resources can be developed to commercial advantage.

The Dominion Government and the Provincial Government of British Columbia have obtained stream flow records at various points. Some records cover periods of two or three years only, while others range from six to fifteen years.

In the British Columbia section readings have been taken or are being taken at forty-five stations. In the Yukon Territory stream flow measurements are extremely limited but miscellaneous measurements have been made on the Lewes, Stewart and Mayo Rivers, and at Janet Creek.

I am very glad to say that in September of this year an aerial reconnaissance was made by officers of our Dominion Water and Power Bureau, of river basins of northern British Columbia and the Yukon Territory, through funds provided by the Department of Mines and Resources.

The primary purpose of this reconnaissance was to investigate the possibility of establishing key hydrometric stations in territory hitherto more or less inaccessible. At the same time the reconnaissance would afford a general knowledge of the topography of the country and the characteristics of its rivers and lakes.

The courses of more than twenty-five northern rivers were followed and an equal number of lakes of good size were observed. The opportunity was also taken during the reconnaissance of establishing new gauging stations at seven points in the Yukon and northern British Columbia. These stations will form the nucleus of a future hydrometric program.

The reconnaissance survey revealed some additional sites to those already known, and also gave further information on canyons on eight or nine rivers that offer power possibilities. In addition, the reconnaissance of September 1943 confirmed and enlarged previous information of power sites on thirteen other rivers.

Many of the northern rivers, particularly in their lower reaches, are very favourable for water transportation. In developing power, the importance of this use of water should not be overlooked. When power development is being planned the effect on water transportation must be kept in mind.

The next step proposed is a more detailed investigation of water power sites on the basis of:-

- (a) Most economic power available,
- (b) The likelihood of it being required for the development of natural resources in adjacent areas.

Several questions require careful study in connection with water power development in the Northwest. These will affect design of power installations, the transmission of power, and maintenance.

Among these problems are the following:-

- (a) Ice occurrences in rivers and lakes, including fragile ice.
- (b) Icing of penstocks, intakes, and surge tanks.
- (c) Length of transmission lines that are feasible.
- (d) The arrangement for additional meteorological records including temperatures, precipitation of both rain and snow.

It is hoped that in the coming year we will be able to make substantial progress along the lines indicated.

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