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WATER POWERS

BRITISH COLUMBIA

CANADA

ANNUAL REVIEW

JULY 1965

WATER RESOURCES SERVICE  
Department of Lands, Forests, and Water Resources

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# ELECTRIC POWER DEVELOPMENT

JULY 1965

The past year, 1964, was the most significant one in the whole history of power development in British Columbia. Ratification of the Columbia River Treaty, the culmination of twenty-one years study and discussion, launched a programme of construction that will total well over a thousand million dollars by the time it is completed. A brief history of events leading up to the initial signing of the Columbia Treaty appeared in the 1963 edition of this Review; and in view of the great importance of this development to the Province, the text has been up-dated and appears as an Appendix to this edition.

## Generation and New Developments

During 1964 the total amount of energy generated by hydro-electric plants in British Columbia was 15,558,186 megawatt-hours, representing an increase of 9.1% on the corresponding figure for 1963. Thermal-electric generation amounted to approximately 1,520,000 megawatt-hours and represents an increase of 11.5% on the previous year's figure.

The provincial totals for electrical energy generated during the last ten years are listed in Table I. It will be noted that the overall increase from 1954 to 1964 is 14.5%, or an average of 9.4% per annum (compounded).

Current details of operating hydro-electric generating plants in British Columbia appear in Tables II(a) and II(b), and additions over the last ten years are shown in Table III. A list of hydro-mechanical plants appears in Table IV. It will be noted that no new hydro-installations were placed in operation during 1964.

## Impending additions to existing plants

It is expected that the third 150 megawatt thermal generating unit will soon be in operation at the Burrard plant owned by the B.C. Hydro and Power Authority. A fourth unit now on order will probably come into operation in late 1967.

During 1964 the Consolidated Mining and Smelting Co. placed orders for the fourth 90 megawatt unit for the Waneta Plant on the Pend d'Oreille River. Installation is scheduled for completion in early 1966. This will bring the Waneta Plant up to its planned installation of 360 megawatts.

In April 1964 the West Kootenay Power and Light Co. completed the replacement of the head-water control dam at the Lower Bonnington Plant on the Kootenay River. A forty year old rock-filled wood-crib dam was replaced by a concrete structure containing provision therein for a possible future generating unit. The Company is providing for an increase in the capacity of the plant by 15 to 20 megawatts, in order to bring the hydraulic capacity in line with the other plants on the Kootenay River.

Crown Zellerbach Canada Ltd., as part of a major modernization and expansion programme, will be replacing their six hydro-mechanical units at Ocean Falls with three 6,000 HP turbines, the power from which will drive the grinders in the Company's groundwood mill.

## Undeveloped Power

For some years the Water Resources Branch of the Department of Northern Affairs and National Resources, Government of Canada and the Water Rights Branch of the Department of Lands, Forests and Water Resources, Government of British Columbia have been engaged in the compilation of an Index of known undeveloped hydro-electric power sites in British Columbia, which is in fact part of a study covering the whole of Canada. The assembly of data is now more or less complete and a summary, showing the totals for different areas of the Province, appears in Table V. It must be pointed out that the figures are for "known" sites only, many of which have only received a rather cursory examination, and that an additional substantial potential, although not yet subject to study, is known to exist. Further details may be obtained, from either of the two departments afore-mentioned, by persons or organizations who require them; however, due to the doubtful basis on which some of it is based, no data may be republished or quoted. The reason for this is that the Index merely lists the figures derived by many different investigators over the course of thirty years or so, and reference should therefore be made to the original work in order to assess the current validity and relevance of the conclusions.

## Planning - Fraser River

Upon the submission of its Final Report in the early part of 1964, the Fraser River Board terminated its activities; its recommendations however are still under serious consideration. Improvement of the dykes in the Lower Mainland area is proceeding with joint assistance from the Governments of Canada and British Columbia. One of the proposals of the report, the possibility of providing flood control and power by the diversion of the McGregor River into the Portage Mountain reservoir, is being studied, with particular reference to the spillway capacity required at Portage Mountain.

## Development - Columbia River

DUNCAN LAKE PROJECT - Prior to the start of construction activity, details of reservoir clearing requirements were issued by the Comptroller of Water Rights in August 1964. It has since been announced by B.C. Hydro and Power Authority that the clearing specified will be carried out prior to flooding.

On 19 May 1965 Premier W.A.C. Bennett led a contingent of dignitaries to Duncan Lake Dam where a dynamite blast was set off marking the official opening of the project.

During the period July 1964 to July 1965 various contracts were awarded ranging in size from a \$35,000 contract for trash-racks up to a \$15,800,000 contract for the construction of the main dam; details of the major contracts awarded to date are shown in Table VII.

The construction highlights for the period were the completion of the overburden removal in March 1965 and the completion of the tunnel excavation in July 1965. A number of properties to be flooded have already been purchased by the Hydro Authority. Construction progress is ahead of schedule on virtually all phases of the project.

In April 1965 a report was issued by the Fish and Game Branch dealing with the effect the dam will have on the fish and game populations of the area. This was followed by an announcement in July that a comprehensive research of the fisheries was being initiated.

ARROW LAKE PROJECT - On 20 May 1965 Premier W.A.C. Bennett officiated at ceremonies held at Arrow Lakes damsite to mark the official opening of the project.

During the period July 1964 to July 1965 several contracts were awarded, as listed in Table VII, the largest of which was for the construction of the main dam and concrete structures. The total value of these contracts was \$60,200,000.

Prior to bidding on the concrete out-off wall contract, several contractors conducted tests at the site on the applicability of their proposed methods of construction.

In August 1964 the Comptroller of Water Rights issued clearing requirements regarding Arrow Lakes Reservoir and it was subsequently announced by B.C. Hydro and Power Authority that these specifications would be exceeded in some aspects and that clearing of the flooded area would be completed prior to flooding.

During December 1964 the C.P.R. relocation near the damsite was completed. May 1965 marked the completion of the water system to supply the Celgar mills with water during construction of the dam; and also the completion of arrangements for water supply to the people living downstream from the dam whose existing water supply system might be adversely affected by construction activity. Dredging operations at the damsite were also commenced in May 1965.

Land acquisition appears to be proceeding satisfactorily.

MICA CREEK - The main highlight of the past year at Mica Dam was the awarding of contracts to a total amount of \$4,800,000 as shown in Table VII. Very little construction activity has been scheduled, but bids have been invited for the construction of the two diversion tunnels, which will mark the start of major construction activity.

Of particular interest is the fact that most of the contracts awarded cover the establishment of a permanent construction town about six miles downstream from the dam site. This will allow a considerable saving in cost over the customary method whereby each contractor provides temporary accommodation for his own employees and dismantles it on completion of his contract.

#### Development - Peace River

PORTAGE MOUNTAIN - Construction activity at the Portage Mountain Dam has continued to increase at a great rate. Although the main dam contract is running slightly behind schedule the overall project is proceeding as planned.

One of the highlights of the year's activities was the successful operation of the conveyor system which carries the fill to damsite. Fill placement commenced in August 1964 and continued until November 1964, by which time approximately five million cubic yards of material had been placed.

Upon completion of the year's fill placing activities, a research program was initiated to evaluate the effectiveness of several methods of preventing frost penetration into the embankment during the winter shutdown period. Fill placement operations recommenced during April 1965 and since that time have been progressing at a reasonably satisfactory rate. The volume placed thus far in this construction season is somewhat behind schedule but it is expected that projected volume of fill will have been placed by the end of the season.

The other highlights of the year were the awarding of contracts for the construction of the transmission line, approximately \$15,400,000, and further contracts for the powerhouse construction and equipment, approximately \$91,100,000. Table VII lists the more important contracts awarded and some of the pertinent details.

THE COLUMBIA RIVER TREATY  
A BRIEF HISTORICAL REVIEW

International planning for the development of the Columbia River dates back to 1944 when reference first was made to the International Joint Commission, by the Canadian and United States governments, to study and recommend on possible plans of development. This task was assigned to a special committee known as the International Columbia River Engineering Board. The Board functioned from 1944 until 1959 and was largely, though not always directly, responsible for the many studies that were done during that period.

Until about 1955 the principal task was that of collecting and collating all relevant data. Subsequently the various alternative overall plans of development were formulated and assessed including proposals for large-scale diversions from the Kootenay River to the Columbia River and from the Columbia River to the Fraser River system. These diversion plans established the fact that Canada had the right to divert a large proportion of the flow of the Kootenay River into the Columbia and both this and an even larger portion of the Columbia flow into the Fraser, and that these diversions are feasible from an engineering point-of-way.

Such proposals, if implemented, would result in a very substantial loss of power at downstream plants in the United States; and this possibility caused considerable alarm in the United States. Undoubtedly some of the credit for the successful negotiation of the Columbia Treaty must be given to the diversion proposals. The reason for this is that previously there had been no pressure or legal obligation for the United States to share the benefits, which would result incidentally in their country from the construction of storage reservoirs in Canada.

Dating from about 1955 therefore, the studies of the Columbia development took on a new tempo. The International Columbia River Engineering Board, having completed much of the preliminary work, commenced the job of compiling a final report. In 1956, the B.C. Government, through the Comptroller of Water Rights, initiated a two-year study by the Vancouver consulting firm of Crippen-Wright Engineering Ltd., who summarized their findings in a nine-volume report. In 1957, the governments of Canada and the United States initiated talks at the diplomatic level, and authorized the carrying out of preliminary field work and cost estimates. It should also be recorded that, during 1957, an electronic computer was used for the first time, in making the long and involved power studies, required for the assessment of the proposed Columbia hydro-electric system.

The year 1958 was largely one of technical study, and the diplomatic talks were temporarily discontinued. The Crippen-Wright report was completed and copies made available to various officials in Ottawa. As the question of sharing downstream benefits was still at the negotiating stage, the report was otherwise kept strictly confidential and was not released for public information until 1963.

In the Crippen-Wright report it was recommended that, if a satisfactory sharing of downstream benefits could be made, the Arrow Lakes and Libby storages should be built. Economic comparisons were also made for several alternative plans of diverting the Kootenay Waters to the Columbia. These comparisons showed that the full diversion plan was much less economic than had been previously supposed, and when other resource losses were also taken into account, it was found to be unattractive. The knowledge derived from this report was therefore extremely useful when Treaty negotiations eventually took place.

The International Columbia River Engineering Board report was presented to the International Joint Commission in March 1959, although most of the appendices were not yet ready and took another year or so to complete. The report presented three primary schemes of ultimate overall basin development, with differences between them based solely on the magnitude of diversion from the Kootenay River to the Columbia River. The Arrow Lakes project was included in all three though an alternative without it was presented also. So far as international development was concerned there were no outstanding differences between the three major schemes; and the I.C.R.E.B. recognized that it was not qualified to consider the division of benefits and costs that would be involved by cooperative development between the two countries.

To prepare for the ultimate negotiations and to work out a mutually agreeable approach on the Columbia development the Canada-British Columbia Policy Liaison Committee was formed with ministerial and senior official representation from both governments. This Committee met regularly as required throughout all the subsequent stages of negotiation leading to the drafting of a Treaty to assess the various proposals and to provide advice to the Canadian negotiators.

The stage was now set for the negotiation of cooperative arrangements for development and as a preliminary the Canadian and United States governments made a joint reference to the International Joint Commission to formulate principles upon which a Treaty could be negotiated. Discussions took place throughout 1959 and assistance was obtained from a special Work Group composed of technical officials from both countries. The International Joint Commission presented their report in a series of "Principles", which recommended sharing all downstream benefits equally with each country paying the costs within its own boundaries.

Early in 1960 the two senior governments appointed teams to negotiate and recommend a draft Treaty. British Columbia was represented on the Canadian negotiating team. A year of most intensive work ensued with the negotiators meeting, on the average, about once a month. In between the negotiating meetings a vast amount of technical study was carried out, and policy discussions were held between the representatives of the Canadian and British Columbia governments. At the start it was made plain that, as shown in the Crippen-Wright report, full diversion of the Kootenay was undesirable, but that it might however be attractive to Canada if adequate inducements were offered by the United States. It should be noted that the Crippen-Wright findings were based purely on project costs, and the damaging impact of the development on the flourishing economy of the East Kootenay valley was not assessed in that report. It should be emphasized that at no time during the negotiations was the desirability of the Arrow Lakes project ever in doubt, nor was it ever considered to be an alternative to the East Kootenay flooding.

In October 1960 the Negotiating Teams presented a Progress Report to the two national governments, which included an outline of a possible Treaty. This was received and approved by the two governments, and a final draft was presented by the two teams in early January of 1961. The official seal of approval was placed on this by the signing of the Treaty by President Eisenhower and Prime Minister Diefenbaker a few days later. Final approval however is subject to ratification by the respective legislatures. This was soon done by the United States Congress but was delayed by the Canadian Parliament, until arrangements for financing the scheme and the sale of power surplus to Canadian requirements had been made.

Under the Treaty, which takes effect from the date of ratification and not of signing, Canada is committed to building 15,500,000 acre-feet of storage, at Mica, Arrow Lakes and Duncan Lake; while the United States is obliged to share the power benefits resulting from the improved regulation of the river equally with Canada. In addition the United States will pay Canada a lump sum of \$64.4 million for flood control.

The B.C. government had for some time indicated that it expected that the British Columbia Power Commission would be entrusted with building and operation of the Treaty dams. The Power Commission therefore retained a number of consulting engineers to carry out the necessary investigations and studies leading to the final design of the individual projects. This work was pressed forward with utmost vigour in order to be prepared for the immediate start of construction as soon as the Treaty was ratified.

In June 1961 the Commission applied to the Comptroller of Water Rights for Water licences covering the three storage projects. Owing to the large number of objections he received, the Comptroller decided to hold public hearings and these took place during September and October.

At that time (April 1962) it was expected that construction would commence on Duncan Lake and possibly Arrow Lakes dams within a few months. However Parliament did not take up the matter of ratification of the Treaty immediately, and during the later part of 1962 negotiations were commenced on the sale of downstream benefits in the United States.

When Parliament was dissolved early in 1963, progress towards a solution received a momentary setback. The new Government of Canada, however, after reviewing progress to date, pressed on with negotiations and an International Work Group was formed of experts from the United States and Canada. This Work Group carried out extensive studies, using electronic computers, to determine as accurately as possible what the downstream power benefits under the Columbia Treaty would be. The results of these studies were presented to the governments concerned at the end of 1963.

In the early part of 1964 the protocol to the Columbia River Treaty was signed by the two countries. This protocol serves to clarify several points in the Treaty so that there can be no doubt as to its interpretation. Attached to it are the general conditions covering the terms of sale of the Canadian entitlement to downstream benefits. In addition, it clarifies several small technical points to the Treaty. The terms of sale of the Canadian entitlement are as follows:- The United States is to pay Canada in U.S. funds the sum of \$254.4 million for the downstream power benefits and \$64.4 million for flood control benefits.



These monies are estimated to be sufficient to pay for the full capital costs of Mica, Arrow and Duncan storage projects. This will ensure low cost at-site generation when it is needed from the Columbia generation plants.

Prior to commencement of the negotiations on the sale of the Canadian entitlement, a Canada - B.C. Agreement was signed covering the Columbia River development. A further Agreement was signed prior to the finalization of the Protocol and the Terms of Sale of the Canadian entitlement.

The External Affairs Committee of the House of Commons held hearings on the Columbia River Treaty during April and May of 1964. The government of British Columbia presented a brief to this committee, as did many other interested parties. The External Affairs Committee recommended in favour of the Treaty, and by a subsequent votes in the House of Commons and Senate, final approval was achieved.

Formal ratification of the Columbia River Treaty took place on the 16th of September 1964 at the Peace Arch, near Blaine, Washington, which marks the western end of the boundary between the U.S. and Canada. A cheque for \$273,291,661.24, in payment for Canada's downstream power benefit entitlement, was deposited the same day to B.C.'s credit in Vancouver. The ceremonies at the Peace Arch were attended by President Johnson on behalf of the United States and Prime Minister Pearson on behalf of Canada.

TABLE I

ELECTRICAL GENERATING STATISTICS FOR BRITISH COLUMBIA  
1954 - 64

Year	ELECTRICAL GENERATION IN MWH		Total	Total in Aver. Mw.	Increase on previous year %
	Hydro (1)	Thermal (2)			
1954	6,384,762	568,780	6,953,542	793.8	13.57
1955	7,859,933	628,080	8,488,013	968.9	22.05
1956	9,315,129	740,058	10,055,187	1,147.8	18.47
1957	10,161,546	586,385	10,747,931	1,226.9	6.90
1958	11,218,679	704,077	11,922,756	1,361.0	10.93
1959	11,750,270	779,915	12,530,185	1,430.3	5.09
1960	12,669,191	1,020,756	13,689,947	1,562.8	9.26
1961	12,371,019	1,050,087	13,421,106	1,532.1	- 1.96
1962	13,571,637	1,208,716	14,780,353	1,687.3	10.13
1963	14,262,400	1,362,841	15,625,241	1,783.7	5.72
1964	15,558,186		(3) 17,080,000	1,944.4	9.31

(1) From Water Rights Branch records.

(2) From Bureau of Economics and Statistics

(3) Estimate

TABLE II (a)

PRINCIPAL PRODUCERS OF ELECTRIC POWER IN BRITISH COLUMBIA

	<u>Installed Capacity (Kw)</u>	
	<u>Hydro</u>	<u>Thermal</u>
<u>UTILITIES</u>		
B.C. Hydro	1,303,002	587,870
The Corporation of the City of Nelson	8,670	
The Corporation of the City of Revelstoke	4,900	2,000
East Kootenay Power Co. Ltd.	13,600	
Mirror Lake Power Ltd.	150	
West Kootenay Power and Light Co. Ltd.	42,280	
<u>INDUSTRIES</u>		
Aluminum Co. of Canada Ltd.	707,200	8,000
Anaconda Co. (Canada) Ltd.	6,150	
Bralorne Pioneer Mines Ltd.	1,475	
B.C. Forest Products Ltd.		12,800
B.C. Bridge & Dredging Co. Ltd.		2,272
B.C. Sugar Refining Co. Ltd.		3,750
Canadian Fishing Co. Ltd.	450	
Canadian Forest Products Ltd.		15,000
Cariboo Gold Quartz Mining Co. Ltd.		1,875
Carnegie Mining Corporation	200	
Columbia Cellulose of Canada Ltd.		15,000
Consolidated Mining & Smelting Co. of Canada	496,235	4,500
Crown Zellerbach Ltd.	13,320	14,500
Crown Zellerbach Building Materials Ltd.		12,500
Dolly Varden Mines Ltd.	1,200	
Eagle Lake Sawmills Co. Ltd.		1,800
Elk Falls Co. Ltd.		1,600
Ocean Cement Co. Ltd.	375	
Giant Mascot Mines Ltd.	100	
Hillcrest Lumber Co. Ltd.		2,610
MacMillan, Bloedel and Powell River Ltd.	53,750	87,150
Rayonier Canada Ltd.	4,250	23,200
S.M. Simpson Ltd.		7,750
Totals	2,657,307	804,177
TOTAL Hydro plus Thermal		<u>3,461,484</u>

TABLE II (b)

PRINCIPAL PRODUCERS OF ELECTRIC POWER IN BRITISH COLUMBIA

DETAILS OF PLANTS IN OPERATION

Owner	Hydro Plant Code No.	Name of Plant	Locality	Type (1)	Nameplate Capacity in Kw.
B.C. Hydro & Power Authority (Hydro Plants)	7100	Alouette	Mission	H	8,000
	7150	Ash River	Alberni	H	25,200
	7310	Big Falls	Prince Rupert	H	6,800
	7360	Bridge River No. 1	Lillooet	H	180,000
	7410	Bridge River No. 2	Lillooet	H	248,000
	7570	Cheakamus	Squamish	H	140,000
	1870	Clayton Falls	Bella Coola	H	702
	7720	Clowhom	Squamish	H	30,000
	7770	Coquitlam-Buntzen	Port Moody	H	76,700
	8330	John Hart	Campbell River	H	120,000
	8380	Jordan River	Victoria	H	26,400 (2)
	8600	La Joie	Bralorne	H	22,000
	8650	Ladore Falls	Campbell River	H	54,000
	8980	Puntledge	Courtenay	H	27,000
	9040	Ruskin	Mission	H	105,600
	9100	Seton	Lillooet	H	42,000
	9150	Shawatlans	Prince Rupert	H	1,400
	9200	Shuswap Falls	Vernon	H	5,200
	9300	Spillimacheen	Golden	H	4,000
	9350	Stave Falls	Mission	H	52,500
9570	Strathcona	Campbell River	H	33,750	
9630	Wahleach	Chilliwack	H	60,000	
9730	Whatchan	Arrow Lakes	H	33,750	
B.C. Hydro & Power Authority (Thermal Plants)			Alert Bay	D	1,200
			Bella Coola	D	1,057
			Blue River	D	575
			Boston Bar	D	950 (3)
			Burns Lake	D	2,936
			Chetwynd	G	12,000
			Dawson Creek	G	20,000
		Fort Nelson	G	3,161	

TABLE II (b) (Continued)

- 2 -

Owner	Hydro Plant Code No.	Name of Plant	Locality	Type (1)	Nameplate Capacity in Kw.	
B.C. Hydro & Power Authority (Thermal Plants)			Hazelton	D	1,450	
			Houston	D	1,200	
			Kamloops	D	4,500 (3)	
			Lytton	D	954	
			McBride	G	1,800	
			Port Hardy	D	1,700	
			Prince George	G	21,000 (3)	
			Prince Rupert	D	6,401	
			Queen Charlotte	D	306 (3)	
			Quesnel	G	3,000 (3)	
			Sandspit	D	1,200	
			Smithers	D	3,880	
			Stewart	D	375	
			Tofino	D	400 (3)	
			Valemount	D	1,050	
			Mobile Unit No. 80 (road)		D	500
			Mobile Unit No. 81 (road)		D	500
			Mobile Unit No. 82 (road)		D	500
			Mobile Unit No. 83 (road)		D	500
			Mobile Unit No. 84 (rail)		D	1,000
			Mobile Unit No. 85 (rail)		D	1,000
			Mobile Unit No. 86 (rail)		D	1,000
			Mobile Unit No. 87 (semi-mobile)		T	5,000
			Mobile Unit No. 88 (rail)		D	1,000
			Mobile Unit No. 89 (rail)		D	1,000
			Mobile Unit No. 90 (rail)		D	1,000
			Mobile Unit No. 91 (rail)		D	1,000
			Burrard	Port Moody	S	300,000 (4)
			Georgia	Chemainus	T	75,500 (3)
			Port Mann	Port Mann	T	100,000 (3)
			Transfers in progress			7,275

TABLE II (b) (Continued)

- 3 -

Owner	Hydro Plant Code No.	Name of Plant	Locality	Type (1)	Nameplate Capacity in Kw.
Corporation of the City of Nelson	7620	City of Nelson	Nelson	H	8,670
Corporation of the City of Revelstoke	7900	Walter Hardman	Revelstoke	H	4,000
	8270	Illecillewaet River	Revelstoke	H	900 (3)
			Revelstoke	D	2,000 (3)
East Kootenay Power Co. Ltd.	7050	Aberfeldie	Fernie	H	4,000
	7930	Elko	Fernie	H	9,600
Mirror Lake Power Ltd.	1420	Byerkness-Mirror	Kaslo	H	150
West Kootenay Power and Light Co. Ltd.	8050	Goat River	Creston	H	1,280 (3)
	8700	Lower Bonnington	Nelson	H	41,000
Aluminum Co. of Canada Ltd.	1090	Kemano	Kitimat	H	707,200
Anaconda Co. (Canada) Ltd.(5)	7260	Beach Powerhouse	Kitimat	D	8,000
			Britannia Beach	H	6,150
Bralorne Pioneer Mines	7520	Cadwallader-Bralorne	Bralorne	H	800
	8210	Hurley River No. 2	Bralorne	H	675
B.C. Forest Products Ltd.			Victoria	S	4,500
			Youbou	S	4,300
			Hammond	S	4,000
B.C. Bridge & Dredging Co. Ltd.			Vancouver	D	2,272
B.C. Sugar Refining Co. Ltd.			Vancouver	S	3,750
Canadian Fishing Co. Ltd.(5)	1660	Butedale Creek	Princess Royal Island	H	430
	4160	Mercantile Creek	Ucluelet	H	20

TABLE II (b) (Continued)

- 4 -

Owner	Hydro Plant Code No.	Name of Plant	Locality	Type (1)	Nameplate Capacity in Kw.
Canadian Forest Products Ltd.			Port Mellon	S	5,000
			Vancouver	S	10,000
Cariboo Gold Quartz Mining Co. Ltd.			Wells	D	1,875
Carnegie Mining Corporation (5)	5640	Slocan Star	New Denver	H	200
Columbia Cellulose of Canada Ltd.			Watson Island	S	15,000
Consolidated Mining and Smelting Co. of Canada Ltd. (5)	7460	Brilliant	Nelson	H	81,600
	7820	Corra Linn	Nelson	H	40,500
	9250	South Slocan	Nelson	H	47,250
	9520	Upper Bonnington	Nelson	H	55,125
	9680	Waneta	Trail	H	270,000 (4)
	4760	Raging River	Port Alice Kimberley	H S	1,760 4,500
Crown Zellerbach Ltd. (5)	8820	Ocean Falls	Ocean Falls	H	13,320
			Ocean Falls	S	14,500
			New Westminster	S	12,500
Dolly Varden Mines Ltd.	8490	Kitsault River	Alice Arm	H	1,200
Eagle Lake Sawmills Co. Ltd.			Giscome	S	1,500
			Giscome	D	300
Elk Falls Co. Ltd.			Duncan Bay	S	1,600
Ocean Cement Ltd.	4220	Munro Creek	Port Moody	H	375
Giant Mascot Mines Ltd.	5520	Silverhope-Steelhead	Hope	H	100
Hillcrest Lumber Co. Ltd.			Mesachie Lake	S	2,610

TABLE II (b) (Continued)

- 5 -

Owner	Hydro Plant Code No.	Name of Plant	Locality	Type (1)	Nameplate Capacity in Kw.
MacMillan Bloedel & Powell River Ltd. (5)	8930	Powell River	Powell River	H	21,350
	9400	Stillwater	Powell River	H	32,400
			Powell River	S	16,450
			Vancouver	S	4,750
			Chemainus	S	3,750
			Port Alberni	S	27,000
			Harmac	S	35,200
Rayonier Canada Ltd.	880	Port Alice	Port Alice	H	2,000
	9780	Woodfibre	Squamish	H	2,250
			Port Alice	G	16,200
			Woodfibre	S	7,000
S.M. Simpson Ltd.			Peachland	S	750
			Kelowna	S	7,000

- NOTES: (1) Type of plant: H= Hydro; D = Diesel; G = Gas diesel; T = Gas turbine; S = Steam.  
(2) Head conditions normally only permit 25,000 Kw. of capacity at Jordan River.  
(3) Used for stand-by or peaking.  
(4) See text for details of impending plant additions.  
(5) Also hydro-mechanical power development - see Table IV.



TABLE III

ADDITIONS TO PRINCIPAL ELECTRICAL GENERATING PLANTS OF BRITISH COLUMBIA DURING THE TEN-YEAR PERIOD 1955-1964

Year (1)	Plant	Capacity added (Kw)	Details
1955	Spillimacheen	4,000	Three units (2)
1956	Ladore Falls	27,000	First unit
	Seton	42,000	New plant
	Whatshan	11,250	Third unit
	Kemano	202,060	Fourth and fifth units
1957	Ladore Falls	27,000	Second unit
	Cheakamus	140,000	New plant
	La Joie	22,000	One unit (3)
	Kemano	101,030	Sixth unit
1958	Clowhom	27,000	Rebuilt (tot. 30,000 Kw)
	Strathcona	33,750	New plant
	Kemano	101,030	Seventh unit
	Georgia (thermal)	37,000	First two units
1959	Ash River	25,200	New plant
	Port Mann (thermal)	100,000	
	Bridge River No. 2	124,000	First two units
	Georgia (thermal)	38,500	Third and fourth units
1960	Bridge River No. 2	124,000	Third and fourth units
	Walter Hardman	4,000	First unit
	Big Falls	3,900	Second unit
1961	Clayton	702	New plant
1962	Burrard (thermal)	300,000	First two units
	Raging River	1,760	Rebuilt
1963	Waneta	90,000	Third unit
1964		none	
Total installed during 10 year period		1,587,182	

(1) Year of commencement of operation, or availability for operation.

(2) Two reconditioned units of 900 Kw. from old Barriere plant, and one new unit of 2,200 Kw.

(3) Added to existing storage dam.

TABLE IV

OPERATING HYDRO-MECHANICAL POWER PLANTS IN BRITISH COLUMBIA

Owner	Hydro Plant Code No.	Name of Plant	Locality	Installation in Hp
Anaconda Co. Canada Ltd.	9460	Tunnel Powerhouse	Brittania Beach	1,100
Consolidated Mining and Smelting Co.	5940	Sullivan	Cranbrook	360
Crown Zellerbach Ltd.	8820	Ocean Falls	Ocean Falls	12,600
James J. Donaldson	2720	Georgetown Creek	Prince Rupert	230
MacMillan Bloedel & Powell River	8930	Powell River	Powell River	26,760
Canadian Fishing Co. Ltd.	1660	Butedale Creek	Princess Royal Island	245
Carnegie Mining Corporation	5640	Slocan Star Plant	New Denver	100
Total for BRITISH COLUMBIA			Hp	41,395

TABLE V

SUMMARY OF UNDEVELOPED POWER SITES IN BRITISH COLUMBIA

	Area	Description	Prime Power (Kw)
7E	Upper Peace River Basin	Above Hudson Hope	1,980,000
7F	Lower Peace River Basin	Below Hudson Hope	570,000
8B	Northern Coast	Includes Yukon Diversion	3,930,000
8C	Lower Northern Coast	Includes Stikine & Iskut Rivers	890,000
8D	Nass River Basin Area		870,000
8E	Skeena River Basin		1,010,000
8F	Central Coastal Area	Rivers Inlet north to Skeena Basin	270,000
8G	Lower Coastal Area	Vancouver north to Rivers Inlet	1,070,000
8H	Vancouver Island		220,000
8J	Nechako River Basin		550,000
8K	Upper Fraser River Basin	Above Macalister, B. C.	1,000,000
8L	Thompson River Basin		1,440,000
8M	Lower Fraser River Basin	Below Macalister, B. C.	5,130,000
8N	Columbia River Basin		2,590,000
8Ø	Queen Charlotte Islands		10,000
10B	Upper Liard River Basin		<u>2,400,000</u>
		TOTAL	23,930,000

Note: This summary is a tabulation of "known" sites only and is based in many cases on very preliminary information. Some sites may prove to be not feasible or not representative of best resource development. See page 2 of text.

TABLE VI

MAJOR HYDRO-ELECTRIC PROJECTS UNDER CONSTRUCTION

	Mica Creek	Arrow Lakes	Duncan Lake	Portage Mountain
Electrical installation in megawatts	1820	none	none	2300 (a)
Height of dam (feet)	645 (b)	190	120	600(c)
Volume of dam (million cu. yds)	37.0	8.5	6.4	56.7 (d)
Type of dam	Rockfill	Earthfill	Earthfill	Earthfill
Reservoir storage volume )Live (millions acre-feet )Gross	12.0 20.0	7.1 7.1	1.4 1.4	32.0 62.0 (c)
Average flow (C.F.S.)	20,700	39,800	3,600	35,000
Drainage area (sq. miles)	8,220	14,100	925	27,000
Scheduled to commence operation	April 1973 (storage only)	April 1969	April 1968	October 1968

<u>Feature</u>	<u>World rank</u>
(a) Underground powerhouse installation	First
(b) Height of fill	Third
(c) Height of fill	Fourth
(d) Volume of fill	Seventh
(e) Gross storage volume	Fifth

TABLE VII

PRINCIPAL CONTRACTS AWARDED FOR HYDRO-ELECTRIC CONSTRUCTION  
JULY, 1964 - JULY, 1965

PROJECT	NATURE OF CONTRACT	SUCCESSFUL CONTRACTOR	CONTRACT PRICE	TOTALS
PORTAGE MTN.	Powerhouse Access Tunnels	Northern Construction and J.W. Stewart Ltd.	\$ 1,767,830	\$ 91,104,592
	Turbines	Mitsubishi International Corporation	4,684,708	
	Generators	Canadian General Electric	7,600,000	
	Site Clearing	Lodon Contracting and Developing Co.	64,147	
	Powerhouse	Northern, Morrison Knudson, Perini, Jones Co.	76,987,907	
PORTAGE MTN.	Transmission Line Hardware	Canadian Ohio Brass Co.	\$ 229,435	\$ 15,543,636
	Transmission Line Towers	Societa Anomima Elettiricazione	1,580,000	
	Transmission Line Conductors	Aluminum Company of Canada	3,500,000	
	Transmission Line Erection	Fishback and Moore Ltd.	4,804,143	
	Microwave Communication System	Collins Radio Co.	5,340,058	
DUNCAN LAKE	Construction of Dam	Mannix, Standard General & Emil Anderson Lt.	\$ 15,800,000	\$ 16,069,913
	Control Gates	Western Bridge Division of Canada Iron Foundries Ltd.	235,036	
	Trash Racks	Royal City Welding and Iron Works	34,877	
ARROW LAKES	Construction of Dam	Foundation Dravo Ltd.	\$ 55,000,000	\$ 60,235,762
	Logging Trucks	Hayes Manufacturing	348,237	
	Cofferdam Cut Off Wall	I Canda Ltd.	4,887,525	
MICA CREEK	Clearing Damsite	Spatsum Lumber Co.	\$ 239,150	\$ 4,841,024
	Construction of Townsite	Feter Kiewit and Sons	1,308,699	
	Construction of 33 Homes	Bennet and White Construction Co.	674,974	
	Construction of Dormitories	A.T. Co. Ltd.	662,000	
	Road Relocation at Dam	Square M and Coleman Collieries Ltd.	1,800,000	
	Construction of School	Tecton Structures Ltd.	156,201	
TOTAL VALUE OF ALL CONTRACTS - JULY, 1964 to JULY, 1965				\$ 187,704,925