COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD

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ENGCW-EY, Rm 5-F-039
Washington, D.C. 20314

15 April 1970

Mr. H. R. Richmond
Chairman, United States Entity
Columbia River Treaty
P.O. Box 3621
Portland, Oregon 97208

Dear Mr. Richmond:

Inclosed is a copy of the recent exchange of notes with the Canadian Embassy pertaining to the Columbia River Treaty hydroelectric operating plans.

Sincerely yours,

Verle Farrow

Verle Farrow
Secretary, U.S. Section

Incl
as

CC:
Gen Kelley w/incl
Mr. Fernald w/incl
H. R. Richmond
B. Goldhammer
H. M. McIntyre

DEPARTMENT OF STATE
THE LEGAL ADVISER

To: Mr. Wendell Johnson
ENGCW-E
Chief of Engineering Division
Civil Works
Office, Chief of Engineers
Department of the Army
Forrestal Building, Room 5-G-033
Washington, D. C. 20314

From: Steven C. Nelson, Office of the Legal Adviser

Enclosed is a copy of the recent exchange of notes with the Canadian Embassy pertaining to the Columbia River Operating Plans.

April 1, 1970

CANADIAN EMBASSY

AMBASSADE DU CANADA

is assigned to

RECEIVED
DEPARTMENT OF STATE
1970 FEB 24 PM 1 18

LEGAL ADVISER

FEB 24 1970

Washington, D.C.,
February 21, 1970.

NO. 54

RS/AN
ANALYSIS BRANCH DEPARTMENT OF STATE

RS/R

Sir,

I have the honour to refer to the Treaty between Canada and the United States of America relating to co-operative development of water resources on the Columbia River basin signed at Washington on January 17, 1961, which entered into force on September 16, 1964.

In accordance with Article IV, Paragraph (1) of the Treaty, I have the honour to propose that the Columbia River Treaty hydroelectric operating plans for Canadian storage during the operating years 1969-70 through 1974-75 dated February 15, 1969, agreed to in an agreement signed on June 6, 1969, by H. L. Keenleyside, Chairman, British Columbia Hydro and Power Authority, Canadian Entity, and on June 2, 1969, by H. R. Richmond, Chairman, United States Entity, as amended by an agreement on hydroelectric operating plans for Canadian storage during the operating years 1969-70 through 1974-75 signed on September 30, 1969, by R. G. Williston, Chairman, Canadian Entity, and on September 23, 1969, by H. R. Richmond, Chairman, United States Entity, copies of which plans and agreements are annexed to this Note, be confirmed and made effective by our two Governments within the meaning of Article IV, Paragraph (1) of the Treaty and that the two Entities be empowered and charged to proceed on the basis herein-before stated.

I should be grateful to know whether this proposal meets with the approval of the Government of the United States of America and whether your Government also confirms the operating plans referred to

DEPARTMENT OF STATE
WASHINGTON

March 30, 1970

Excellency:

I have the honor to refer to your Note No. 54, dated February 21, 1970, together with the attachments thereto regarding the hydroelectric operating plans for Canadian storage during the operating years 1969-70 through 1974-75 dated February 15, 1969 under Article IV, Paragraph (1) of the Treaty between Canada and the United States of America relating to co-operative development of the water resources of the Columbia River basin signed at Washington on January 17, 1961 which entered into force on September 16, 1964.

I wish to advise you that the proposal contained in your note with the attachments thereto meets with the approval of the Government of the United States of America and that your note together with this reply constitutes confirmation of the operating plans referred to in your note by our two Governments within

His Excellency

M. Cadieux,

Ambassador of Canada.

the meaning of Article IV, Paragraph (1) of the Treaty, thus empowering and charging the two Entities to proceed on the basis set out in the enclosures to your note.

Accept, Excellency, the renewed assurances of my highest consideration.

For the Secretary of State:

/S/ Martin J. Hillenbrand

COLUMBIA RIVER TREATY

AGREEMENT

on

HYDROELECTRIC OPERATING PLANS FOR CANADIAN STORAGE

DURING THE OPERATING YEARS 1969-70 THROUGH 1974-75

The Columbia River Treaty between the United States and Canada requires that hydroelectric operating plans be agreed in advance by the Entities for the operation of the storages provided in the Treaty. The Canadian Entity and the United States Entity herewith agree that the Canadian storages will be operated in accordance with the attached "Columbia River Treaty Hydroelectric Operating Plans for Canadian Storage -- Operating Years 1969-70 through 1974-75," dated February 15, 1969.

H. L. Keenleyside
Chairman
British Columbia Hydro and
Power Authority
Canadian Entity

6 VI 69
(Date signed)

H. R. Richmond
Chairman
United States Entity

June 2, 1969
(Date signed)

February 15, 1969

COLUMBIA RIVER TREATY
HYDROELECTRIC OPERATING PLANS
FOR
CANADIAN STORAGE

Operating Years
1969-70 through 1974-75

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February 15, 1969

COLUMBIA RIVER TREATY
HYDROELECTRIC OPERATING PLANS
FOR
CANADIAN STORAGE

Operating Years
1969-70 through 1974-75

INTRODUCTION

The Treaty between Canada and the United States of America relating to the cooperative development of the water resources of the Columbia River Basin requires that each year a hydroelectric operating plan be agreed by the entities for the operation of the Columbia River Treaty storage in Canada during the sixth succeeding year. This plan will assure the entities of the manner of operation of the Canadian storage five years in advance, and is referred to herein as an Assured Operating Plan. Once adopted the Assured Operating Plans shall remain unchanged.

It is further required that before the first storage becomes operative an Assured Operating Plan be agreed for each year until the total of 15.5 million acre-feet of Canadian storage becomes operative. The initial Canadian storage was declared fully operative on July 31, 1967, and the total 15.5 million acre-feet is to become operative by April 1, 1973. The operations of the Duncan Project in 1967-68 and the Duncan and Arrow projects in 1968-69 were covered by special operating programs agreed by the entities and approved by exchanges of notes between the United States and Canadian governments.

In accordance with the foregoing, these operating plans have been prepared for the six operating years (July 1 through June 30) 1969-70 through 1974-75 to provide for optimum generation in the United States in accordance with paragraph 6 of Annex A of the Treaty.

Immediately prior to each operating year, a Detailed Operating Plan will be prepared based on the Assured Operating Plan. If it is considered advantageous and is agreed by the entities, the Detailed Operating Plan will reflect the latest load, resource, and other pertinent data. The Detailed Operating Plan will serve as a guide for actual operation of the Canadian storage.

ASSURED OPERATING PLANS

1. General

The Assured Operating Plans contained herein are in keeping with requirements of the Treaty, its Annexes and related documents and provide criteria necessary to produce optimum power generation in accordance with established utility practice. They also take into account the initial filling programs for the Canadian storage projects and the flood control operating plans required by the Treaty.

The Assured Operating Plan for each operating year consists of an Operating Rule Curve for the whole of the Canadian storage, to serve as a guide in operation of the storage and a set of operating rules including flood control requirements, to be observed in operation of the Canadian storage.

Characteristics of the individual Canadian storages, their filling programs and their flood control reservoir regulation schedules, as well as system regulation studies, component curves and procedures

for developing inflow forecasts and for developing refill curves for the individual Canadian storages from which these Assured Operating Plans have been derived, are in the files of the entities for reference.

2. Operating Rule Curve

The operation of Canadian storage in each operating year shall be guided by an Operating Rule Curve for the whole of Canadian storage. It is designed to realize the optimum usable energy under any streamflow condition, consistent with refilling the reservoirs to protect the system's ability to carry firm loads of the next operating year. The Operating Rule Curve for the whole of the Canadian storage shall be developed from the curves described below. These curves are the sum of similar curves, in terms of storage content, for the individual Canadian storages. The derivation of the Operating Rule Curve is illustrated on Chart 1.

(a) Critical Rule Curve

The Critical Rule Curve gives the end-of-month storage content of Canadian storage during the critical period. It is designed to protect the ability of the system to serve firm load with the occurrence of flows no worse than those during the most adverse historical streamflow period. A summary tabulation of the Critical Rule Curves for the whole of Canadian storage for each of the operating years is included as Table 1.

(b) Refill Curve

The Refill Curve is a guide to operation of Canadian storage which allows the production of the greatest

amount of usable energy consistent with refilling, with an acceptable degree of assurance so as to meet the firm loads of the following year. The end of the refill period for the attached plans is considered to be July 31.

(i) Assured Refill Curve

The Assured Refill Curve gives the end-of-month storage content required to assure refill of Canadian storage based on the second-lowest historical volume of inflow for the whole refill period and as each month of the refill period is passed the second-lowest volume for each remaining portion of the refill period. A summary tabulation of the Assured Refill Curves for the whole of Canadian storage for each of the operating years is included as Table 2.

(ii) Variable Refill Curve

The Variable Refill Curve gives end-of-month storage contents for the period January through July required to refill Canadian storage based on forecast inflow volume during the refill period.

In carrying out the studies for the Assured Operating Plan simulated forecasts, such as would have been made at each date with the information then available, were used to establish the Variable Refill Curves. Similar procedures, using actual forecasts, will be used to establish the Variable Refill Curves for each year's operation. Composite Variable Refill Curves for the

whole of Canadian storage for all 30 years of historical record for the operating years 1969-70 through 1974-75 are included as Tables 3 through 5 to illustrate the probable range of these curves.

(c) Upper Rule Curve

The Upper Rule Curve gives the mandatory end-of-month storage content to which each individual Canadian storage shall be evacuated for flood control and other requirements. The Upper Rule Curves used in the studies were developed from the simulated forecasts mentioned above considering the Flood Control Storage Reservation diagrams and any other limitations. Composite Upper Rule Curves for the whole of Canadian storage for all 30 years of historical record for the operating years 1969-70 through 1974-75 are included as Tables 6 through 9 to illustrate the probable range of these curves.

(d) Definition of Operating Rule Curve

Prior to January 1, the Operating Rule Curve will be defined by the Critical Rule Curve or the Assured Refill Curve, whichever is higher. When the duration of the critical period is more than one year, the Critical Rule Curve for the first year of the critical period will be used in the foregoing determination. Beginning January 1, the Operating Rule Curve shall be defined by first determining the higher of the Critical Rule Curve and the

Assured Refill Curve; the Operating Rule Curve shall then be the lower of the above-determined value or the Variable Refill Curve. At no time shall the Operating Rule Curve be higher than the Upper Rule Curve. Composite Operating Rule Curves for the whole of Canadian storage for all 30 years of historical record for the operating years 1969-70 through 1974-75 are included as Tables 10 through 15 to illustrate the probable range of these curves.

3. Operating Rules

The following rules applicable to storage operation have been used in the 30-year system regulation studies summarized herein to illustrate the probable range of storage operation.

(a) The whole of the Canadian storage may be drafted to its Operating Rule Curve as required to produce optimum generation in accordance with Annex A, Paragraph 6, of the Treaty, subject to project characteristics and operating constraints.

(b) The whole of the Canadian storage will not be drafted below its Operating Rule Curve unless:

(i) Reservoir storage in the United States system has been drafted to its Energy Content Curve; and

(ii) Deliveries of secondary energy in the United States are discontinued; and

(iii) Committed firm thermal and miscellaneous resources

not displaced by surplus firm hydro resources are in operation or other replacement energy has been secured from sources other than those committed.

(c) When the conditions of (b) above are met, and it is necessary to draft additional storage to produce optimum generation as determined by the applicable Critical Period System Regulation study, the whole of the Canadian storage and reservoir storage in the United States System will be drafted proportionately between its Operating Rule Curve or Energy Content Curve, respectively, and its Critical Rule Curve. If the system has a critical period in excess of one year, then the proportionate draft will be made first to the first Critical Rule Curve, then between the first and second Critical Rule Curve, the second and third Critical Rule Curve, et cetera. When it is necessary to operate the whole of the Canadian storage and the United States reservoir storage below their lowest Critical Rule Curves, each shall be operated proportionately between its lowest Critical Rule Curve and its normal minimum content.

(d) Each Canadian storage reservoir will be operated on or below the storage content defined by its Upper Rule Curve.

(e) Canadian reservoirs shall be operated to provide the required flood control regulations. In the event there is a conflict between the flood control requirements and the power requirements, the flood control requirements shall govern.

4. Implementation

These operating plans shall be implemented by the entities as required by the Treaty and in accordance with the Principles and Procedures for the Preparation and Use of Hydroelectric Operating Plans for Canadian Treaty Storage dated July 25, 1967, to which the entities have agreed.

These footnotes apply to the following tables.

Notes

1/ The rule curves for the individual projects totaled to obtain the composite rule curves for Canadian storage consider only usable storage. The actual allowable volume in Mica in terms of storage space below full pool will be calculated in the actual operating year until such time as initial filling is completed.

2/ The Upper Rule Curve is based on the assumption of a transfer of two million acre-feet of flood control storage space from Arrow to Mica. This transfer will be determined each year in accordance with draft of Flood Control Plan dated August 12, 1968, and may not be as assumed in the studies. The composite Upper Rule Curves tabulated herein are for the sole purpose of defining the Operating Rule Curves in instances where the Upper Rule Curve provides for greater draft than the Variable Refill Curve. In the system regulation studies, individual Upper Rule Curves for each Canadian Treaty reservoir were used as an upper limit to reservoir storage content. The tabulated values of the composite Upper Rule Curves for the end of May, June, and July were taken from daily system regulation studies rather than from simulated forecasts and Flood Control Storage Reservation diagrams.

COLUMBIA RIVER TREATY
SUMMARY TABULATION OF COMPOSITE CRITICAL RULE CURVES
FOR THE WHOLE OF CANADIAN STORAGE
END OF MONTH CONTENTS IN KSFD
1969-70 THROUGH 1974-75 OPERATING YEARS

	1970	1971	1972	1973 1/	1974 1/				1975 1/			
					1ST YR	2ND YR	3RD YR	4TH YR	1ST YR	2ND YR	3RD YR	4TH YR
JUL	4313.7	4313.7	4313.7	4313.7	7814.6	6530.4	4815.8	2579.4	7814.6	6618.6	5031.4	2285.4
AUG	4211.4	4169.4	4139.5	4213.0	7674.3	6382.0	4803.6	2636.0	7490.5	5970.9	4712.8	1840.9
SEP	3996.2	4014.6	3659.0	3846.9	6879.0	5093.9	3993.3	2472.5	6742.3	4797.4	3947.1	1609.7
OCT	3547.2	3583.9	3348.3	3620.6	6493.9	4172.2	3064.1	1886.9	6389.7	3909.3	3049.2	1042.9
NOV	2612.1	2651.4	2518.2	3091.7	6513.7	3514.2	2631.2	1376.7	6455.8	3288.6	2656.0	708.8
DEC	1339.6	1400.9	1327.7	2504.6	5612.3	2553.6	1597.4	697.6	5537.1	2399.4	1600.6	98.3
JAN	0.0	0.0	0.0	2081.3	3412.3	1374.7	1214.5	113.8	3314.5	1177.8	1150.1	65.6
FEB	0.0	0.0	0.0	1882.4	2612.5	932.9	460.8	0.0	2457.3	695.6	347.0	0.0
MAR	0.0	0.0	0.0	1226.4	2066.8	825.3	435.8	0.0	1997.8	579.7	322.0	0.0
APR	0.0	0.0	0.0	229.3	1114.6	860.9	362.9	0.0	1058.9	615.3	286.5	0.0
MAY	0.0	0.0	0.0	583.0	2576.6	2191.7	1296.7	0.0	2520.6	2117.3	1282.1	0.0
JUN	0.0	0.0	0.0	1970.8	5555.9	4001.6	2231.7	0.0	5940.8	4219.8	2345.1	0.0

TABLE 1

Note: Duncan and Arrow reservoirs are included in operating years 1969-70 through March 1973. Mica is included beginning April 1973.

COLUMBIA RIVER TREATY
SUMMARY TABULATION OF COMPOSITE ASSURED REFILL CURVES
FOR THE WHOLE OF CANADIAN STORAGE
END OF MONTH CONTENTS IN KSFD
1969-70, 1970-71, 1971-72 OPERATING YEARS

JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
0.0	0.0	22.7	68.7	81.3	93.8	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7

1972-73 OPERATING YEAR 1/

JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR*	MAY	JUN	JUL
0.0	0.0	22.7	358.3	479.3	538.0	630.4	696.5	782.2	971.2	3243.2	5780.0	7814.6

1973-74, 1974-75 OPERATING YEARS 1/

JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
0.0	0.0	142.8	358.3	479.3	538.0	630.4	696.5	782.2	971.2	3243.1	5780.0	7814.6

TABLE 2

*Initial operation of Mica project in April 1973

COLUMBIA RIVER TREATY
COMPOSITE VARIABLE REFILL CURVE
FOR THE WHOLE OF CANADIAN STORAGE
END OF MONTH CONTENTS IN KSFD
1969-70, 1970-71, 1971-72 OPERATING YEARS

FLOW YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
1928-29							160.1	225.9	348.0	420.7	1748.3	3265.7	4313.7
1929-30							302.2	365.1	367.7	464.1	1836.2	3253.5	4313.7
1930-31							295.3	231.4	288.7	374.4	1744.1	3253.5	4313.7
1931-32							10.5	10.0	35.9	114.4	1499.6	3127.1	4313.7
1932-33							113.6	19.9	46.3	110.1	1553.8	3136.2	4313.7
1933-34							0.0	0.0	38.4	136.4	1605.3	3218.3	4313.7
1934-35							20.4	0.0	0.0	62.6	1421.5	3026.4	4313.7
1935-36							205.4	168.0	161.8	242.8	1662.4	3251.4	4313.7
1936-37							406.4	353.7	269.0	417.3	1670.2	3214.3	4313.7
1937-38							0.0	0.0	0.0	62.6	1374.4	3040.9	4313.7
1938-39							25.8	0.0	39.9	170.3	1614.9	3224.9	4313.7
1939-40							145.8	231.4	247.2	358.7	1720.1	3253.5	4313.7
1940-41							141.3	159.1	236.9	401.1	1809.1	3253.5	4313.7
1941-42							36.1	129.4	257.6	449.3	1819.5	3222.8	4313.7
1942-43							75.2	50.6	93.7	155.9	1553.0	3125.6	4313.7
1943-44							256.3	248.3	312.9	454.1	1801.3	3253.5	4313.7
1944-45							285.0	246.2	245.8	255.6	1607.2	3147.2	4313.7
1945-46							67.3	20.9	0.0	62.6	1443.2	3123.4	4313.7
1946-47							120.1	37.3	53.2	182.2	1577.0	3200.3	4313.7
1947-48							122.6	100.6	41.8	155.0	1498.5	3111.8	4313.7
1948-49							130.4	205.6	101.1	218.0	1609.9	3208.3	4313.7
1949-50							203.5	138.3	138.6	173.1	1548.8	3125.4	4313.7
1950-51							0.0	0.0	0.0	62.6	1390.2	3062.0	4313.7
1951-52							51.5	0.0	0.0	99.6	1505.1	3123.6	4313.7
1952-53							459.7	284.4	302.1	338.1	1655.1	3190.8	4313.7
1953-54							372.8	98.2	47.3	115.4	1478.0	3091.6	4313.7
1954-55							276.1	282.9	276.4	345.3	1597.1	3107.6	4313.7
1955-56							34.7	0.0	0.0	62.6	1424.6	3101.1	4313.7
1956-57							121.6	82.8	0.0	72.9	1489.6	3169.5	4313.7
1957-58							239.0	207.6	177.2	264.2	1587.1	3236.4	4313.7

TABLE 2

Note: Based on variable refill curve for the Duncan project and the assured refill curve for the Arrow project.

COLUMBIA RIVER TREATY
COMPOSITE VARIABLE REFILL CURVE
FOR THE WHOLE OF CANADIAN STORAGE
END OF MONTH CONTENTS IN KSFD
1972-73 OPERATING YEAR 1/

FLOW YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
1928-29							1371.5	2192.4	2525.6	2861.0	4530.1	7167.5	7814.6
1929-30							302.2	890.9	367.7	691.2	3154.8	6211.7	7814.6
1930-31							2085.7	2216.6	2464.0	2795.2	4583.3	7493.3	7814.6
1931-32							10.5	10.0	35.9	51.8	3232.7	6212.6	7814.6
1932-33							113.6	19.9	46.3	47.5	1835.5	5779.2	7814.6
1933-34							0.0	0.0	38.4	73.8	856.3	5699.6	7814.6
1934-35							20.4	0.0	0.0	0.0	967.7	5160.8	7814.6
1935-36							788.8	593.3	455.3	577.3	2898.4	7009.8	7814.6
1936-37							2568.6	3090.8	2558.4	3397.8	4750.9	7098.2	7814.6
1937-38							0.0	0.0	0.0	305.1	2500.3	6361.4	7814.6
1938-39							681.3	508.6	145.6	751.7	3253.9	6822.7	7814.6
1939-40							1388.1	2365.9	2310.6	2803.8	4733.3	7101.0	7814.6
1940-41							868.5	1094.8	1586.0	2291.5	4807.6	6960.0	7814.6
1941-42							200.6	1345.5	2036.2	2572.8	4431.8	6763.7	7814.6
1942-43							509.7	899.6	1100.1	1406.9	3501.8	6495.6	7814.6
1943-44							2211.8	2530.1	2805.8	3026.2	4720.7	6977.4	7814.6
1944-45							1762.1	1863.9	1750.8	2015.3	3752.5	6922.9	7814.6
1945-46							542.0	20.9	0.0	0.0	1616.5	6087.0	7814.6
1946-47							345.4	100.9	53.2	283.5	2630.2	6496.4	7814.6
1947-48							1144.5	1551.7	485.4	921.6	2407.6	6362.6	7814.6
1948-49							1276.0	2247.5	1419.8	2171.2	4161.4	7146.4	7814.6
1949-50							1361.9	1235.6	885.1	1205.6	3068.9	6269.4	7814.6
1950-51							63.3	0.0	0.0	0.0	1932.5	5887.3	7814.6
1951-52							635.8	381.9	324.8	946.0	3240.8	6787.3	7814.6
1952-53							3660.1	1441.4	1445.2	1906.0	3516.5	6840.6	7814.6
1953-54							1929.5	1022.6	47.3	457.7	2034.2	5841.0	7814.6
1954-55							1293.0	1738.4	1793.1	1895.8	3472.0	6189.6	7814.6
1955-56							34.7	0.0	0.0	0.0	1770.4	6212.4	7814.6
1956-57							121.6	86.3	0.0	126.4	2586.6	7040.4	7814.6
1957-58							1425.4	1221.7	1134.0	1897.3	3821.6	7238.2	7814.6

TABLE 4

COLUMBIA RIVER TREATY
COMPOSITE VARIABLE REFILL CURVE
FOR THE WHOLE OF CANADIAN STORAGE
END OF MONTH CONTENTS IN KSFD
1973-74,1974-75 OPERATING YEARS 1/

FLOW YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
1928-29							1371.5	2192.4	2525.7	2861.0	4530.1	7167.5	7814.6
1929-30							799.7	1017.5	621.6	691.2	3154.8	6211.7	7814.6
1930-31							2085.7	2216.6	2463.9	2795.2	4583.3	7493.3	7814.6
1931-32							440.9	333.6	35.9	51.8	3232.7	6212.6	7814.6
1932-33							309.8	30.0	46.3	47.5	1835.5	5779.2	7814.6
1933-34							0.0	0.0	38.4	73.8	856.3	5699.6	7814.6
1934-35							20.4	0.0	0.0	0.0	967.7	5160.8	7814.6
1935-36							989.1	786.7	1211.1	577.3	2898.4	7009.8	7814.6
1936-37							2568.6	3090.8	2558.4	3397.8	4750.9	7098.2	7814.6
1937-38							0.0	0.0	0.0	305.1	2500.3	6361.4	7814.6
1938-39							681.3	508.6	145.6	751.7	3253.9	6822.7	7814.6
1939-40							1388.1	2365.9	2310.7	2803.8	4733.3	7101.0	7814.6
1940-41							868.5	1094.8	1586.0	2291.5	4807.6	6960.0	7814.6
1941-42							200.6	1345.4	2036.2	2572.8	4431.8	6763.7	7814.6
1942-43							509.7	899.6	1100.0	1406.9	3501.8	6495.6	7814.6
1943-44							2211.8	2530.1	2805.8	3026.2	4720.7	6977.4	7814.6
1944-45							1762.1	1863.9	1750.8	2015.3	3752.5	6922.9	7814.6
1945-46							542.0	20.9	0.0	0.0	1616.5	6087.0	7814.6
1946-47							345.4	100.9	53.2	283.5	2630.2	6496.4	7814.6
1947-48							1144.5	1551.7	485.3	921.6	2407.6	6362.6	7814.6
1948-49							1276.0	2247.5	1419.8	2171.2	4161.4	7146.4	7814.6
1949-50							1361.9	1235.6	885.2	1205.6	3068.9	6269.4	7814.6
1950-51							173.9	0.0	0.0	0.0	1932.5	5887.3	7814.6
1951-52							635.8	381.9	324.8	946.0	3240.8	6787.3	7814.6
1952-53							3660.1	1441.4	1445.2	1906.0	3516.5	6840.6	7814.6
1953-54							1929.5	1822.6	47.3	457.7	2034.2	5841.0	7814.6
1954-55							1293.1	1738.4	1793.1	1895.8	3472.0	6189.6	7814.6
1955-56							34.7	0.0	0.0	0.0	1770.4	6212.4	7814.6
1956-57							121.6	86.3	0.0	126.4	2586.6	7040.4	7814.6
1957-58							1425.4	1221.7	1134.0	1897.3	3821.6	7238.2	7814.6

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COLUMBIA RIVER TREATY
COMPOSITE UPPER RULE CURVE
FOR THE WHOLE OF CANADIAN STORAGE
END OF MONTH CONTENTS IN KSFD
1969-70, 1970-71, 1971-72 OPERATING YEARS

FLOW YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
1928-29	4313.7	4313.7	4313.7	4212.9	4096.8	3557.4	2927.2	2776.0	3456.6	3431.4	3620.5	3809.5	4313.7
1929-30	=	=	=	=	=	=	2539.0	2387.8	1263.5	1228.2	3628.0	3809.5	4313.7
1930-31	=	=	=	=	=	=	3194.5	3330.6	3381.0	3365.9	3587.7	3809.5	4313.7
1931-32	=	=	=	=	=	=	2297.0	1107.2	98.9	98.9	2095.4	3809.5	4313.7
1932-33	=	=	=	=	=	=	2297.0	1107.2	98.9	98.9	2095.4	3607.9	4313.7
1933-34	=	=	=	=	=	=	2297.0	1107.2	98.9	98.9	3325.5	3809.5	4313.7
1934-35	=	=	=	=	=	=	2297.0	1107.2	98.9	98.9	2259.2	3809.5	4313.7
1935-36	=	=	=	=	=	=	3345.7	2498.7	179.5	179.5	2355.0	3809.5	4313.7
1936-37	=	=	=	=	=	=	3497.0	3426.4	2382.7	2892.0	3522.2	3809.5	4313.7
1937-38	=	=	=	=	=	=	2297.0	1107.2	98.9	98.9	1515.6	3809.5	4313.7
1938-39	=	=	=	=	=	=	2297.0	1107.2	98.9	98.9	2357.5	3809.5	4313.7
1939-40	=	=	=	=	=	=	2423.1	2468.5	219.9	351.0	2408.0	3809.5	4313.7
1940-41	=	=	=	=	=	=	2297.0	1208.0	219.9	2967.6	3592.7	3733.9	4313.7
1941-42	=	=	=	=	=	=	2297.0	1107.2	1621.5	2932.3	3597.8	3809.5	4313.7
1942-43	=	=	=	=	=	=	2297.0	1107.2	98.9	98.9	1187.9	3809.5	4313.7
1943-44	=	=	=	=	=	=	3063.4	3295.3	3365.9	3365.9	3587.7	3809.5	4313.7
1944-45	=	=	=	=	=	=	3093.6	2866.7	2166.0	1006.4	1840.8	3809.5	4313.7
1945-46	=	=	=	=	=	=	2297.0	1107.2	98.9	98.9	2155.9	3809.5	4313.7
1946-47	=	=	=	=	=	=	2297.0	1107.2	98.9	124.1	1924.0	3809.5	4313.7
1947-48	=	=	=	=	=	=	2297.0	1107.2	98.9	98.9	2123.1	3809.5	4313.7
1948-49	=	=	=	=	=	=	2297.0	1208.0	98.9	103.9	2902.0	3809.5	4313.7
1949-50	=	=	=	=	=	=	2297.0	1107.2	98.9	98.9	1200.5	3577.6	4313.7
1950-51	=	=	=	=	=	=	2297.0	1107.2	98.9	98.9	2609.6	3809.5	4313.7
1951-52	=	=	=	=	=	=	2297.0	1107.2	98.9	98.9	3050.8	3809.5	4313.7
1952-53	=	=	=	=	=	=	3481.8	1218.1	179.5	179.5	1261.0	3809.5	4313.7
1953-54	=	=	=	=	=	=	2357.5	1107.2	98.9	98.9	2599.5	3809.5	4313.7
1954-55	=	=	=	=	=	=	2639.9	2881.9	2478.5	1203.0	1936.6	3683.5	4313.7
1955-56	=	=	=	=	=	=	2297.0	1107.2	98.9	98.9	1956.7	3809.5	4313.7
1956-57	=	=	=	=	=	=	2297.0	1107.2	98.9	109.0	3249.9	3809.5	4313.7
1957-58	=	=	=	=	=	=	2337.4	1177.8	129.1	129.1	2483.6	3809.5	4313.7

TABLE 6

COLUMBIA RIVER TREATY
COMPOSITE UPPER RULE CURVE
FOR THE WHOLE OF CANADIAN STORAGE
END OF MONTH CONTENTS IN KSFD
1972-73 OPERATING YEAR 1/ 2/

FLOW YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
1928-29	4313.7	4313.7	4313.7	4313.7	4313.7	3557.4	3078.5	3179.3	3456.6	6932.3	7121.4	7814.6	7814.6
1929-30	=	=	=	=	=	=	2841.5	2791.1	1994.5	6644.9	7128.9	7814.6	7814.6
1930-31	=	=	=	=	=	=	3295.3	3330.6	3381.0	6866.8	7088.6	7814.6	7814.6
1931-32	=	=	=	=	=	=	2650.0	1813.0	1107.2	4608.1	5596.3	7814.6	7814.6
1932-33	=	=	=	=	=	=	2650.0	1813.0	1107.2	4608.1	5596.3	7612.9	7814.6
1933-34	=	=	=	=	=	=	2650.0	880.3	880.3	5087.0	6826.4	7814.6	7814.6
1934-35	=	=	=	=	=	=	2650.0	1813.0	1107.2	4608.1	5760.1	7814.6	7814.6
1935-36	=	=	=	=	=	=	3396.1	2397.9	1187.9	4688.8	5855.9	7814.6	7814.6
1936-37	=	=	=	=	=	=	3497.0	3426.4	2886.9	6846.6	7023.0	7814.6	7814.6
1937-38	=	=	=	=	=	=	2650.0	1813.0	1107.2	4608.1	5016.5	7814.6	7814.6
1938-39	=	=	=	=	=	=	2650.0	1813.0	1107.2	4608.1	5858.4	7814.6	7814.6
1939-40	=	=	=	=	=	=	2700.4	2771.0	1228.2	4759.3	5908.8	7814.6	7814.6
1940-41	=	=	=	=	=	=	2650.0	1913.9	1228.2	6871.8	7093.6	7739.0	7814.6
1941-42	=	=	=	=	=	=	2650.0	1813.0	1218.1	6735.7	7098.7	7814.6	7814.6
1942-43	=	=	=	=	=	=	2650.0	1813.0	1107.2	4608.1	4688.8	7814.6	7814.6
1943-44	=	=	=	=	=	=	3164.2	3295.3	3365.9	6866.8	7088.6	7562.5	7814.6
1944-45	=	=	=	=	=	=	3194.5	3018.0	2771.0	5263.5	5341.6	7814.6	7814.6
1945-46	=	=	=	=	=	=	2650.0	1813.0	1107.2	4608.1	5656.8	7814.6	7814.6
1946-47	=	=	=	=	=	=	2650.0	1813.0	1107.2	4633.3	5424.8	7814.6	7814.6
1947-48	=	=	=	=	=	=	2650.0	1813.0	1107.2	4608.1	5624.0	7814.6	7814.6
1948-49	=	=	=	=	=	=	2650.0	1913.9	1107.2	4613.1	6402.9	7814.6	7814.6
1949-50	=	=	=	=	=	=	2650.0	1813.0	1107.2	4608.1	4701.4	7078.5	7814.6
1950-51	=	=	=	=	=	=	2650.0	880.3	.5	3501.4	6110.5	7814.6	7814.6
1951-52	=	=	=	=	=	=	2650.0	880.3	880.3	4381.2	6551.6	7814.6	7814.6
1952-53	=	=	=	=	=	=	3481.8	1924.0	1187.9	4688.8	4761.9	7814.6	7814.6
1953-54	=	=	=	=	=	=	2710.5	1813.0	1107.2	4608.1	6100.4	7814.6	7814.6
1954-55	=	=	=	=	=	=	2942.4	3134.0	2932.3	5409.7	5437.4	7688.5	7814.6
1955-56	=	=	=	=	=	=	2650.0	880.3	.5	3501.4	5457.6	7310.4	7814.6
1956-57	=	=	=	=	=	=	2650.0	1813.0	1107.2	4618.2	6750.8	7814.6	7814.6
1957-58	=	=	=	=	=	=	2690.3	1883.6	1137.5	4638.3	5984.5	7814.6	7814.6

TABLE 7

COLUMBIA RIVER TREATY
COMPOSITE UPPER RULE CURVE
FOR THE WHOLE OF CANADIAN STORAGE
END OF MONTH CONTENTS IN KSFD
1973-74 OPERATING YEAR 1/ 2/

FLOW YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
1928-29	7814.6	7814.6	7814.6	7814.6	7814.6	7058.3	6579.4	6680.2	6957.5	6932.3	7121.4	7814.6	7814.6
1929-30	=	=	=	=	=	=	6342.4	6292.0	5695.4	6644.9	7128.9	7814.6	7814.6
1930-31	=	=	=	=	=	=	6796.2	6831.5	6881.9	6866.8	7088.6	7814.6	7814.6
1931-32	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	5596.3	7814.6	7814.6
1932-33	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	5596.3	7612.9	7814.6
1933-34	=	=	=	=	=	=	6150.8	4381.2	4381.2	5087.0	6826.4	7814.6	7814.6
1934-35	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	5760.1	7814.6	7814.6
1935-36	=	=	=	=	=	=	6897.0	5898.8	4688.8	4688.8	5855.9	7814.6	7814.6
1936-37	=	=	=	=	=	=	6997.8	6927.3	6387.8	6846.6	7023.0	7814.6	7814.6
1937-38	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	5016.5	7814.6	7814.6
1938-39	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	5858.4	7814.6	7814.6
1939-40	=	=	=	=	=	=	6201.3	6271.8	4729.1	4759.3	5908.8	7814.6	7814.6
1940-41	=	=	=	=	=	=	6150.8	5414.8	4729.1	6871.8	7093.6	7739.0	7814.6
1941-42	=	=	=	=	=	=	6150.8	5313.9	4719.0	6735.7	7098.7	7814.6	7814.6
1942-43	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	4688.8	7814.6	7814.6
1943-44	=	=	=	=	=	=	6665.1	6796.2	6866.8	6866.8	7088.6	7562.5	7814.6
1944-45	=	=	=	=	=	=	6695.3	6518.9	6271.8	5263.5	5341.6	7814.6	7814.6
1945-46	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	5656.8	7814.6	7814.6
1946-47	=	=	=	=	=	=	6150.8	5313.9	4608.1	4633.3	5424.8	7814.6	7814.6
1947-48	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	5624.0	7814.6	7814.6
1948-49	=	=	=	=	=	=	6150.8	5414.8	4608.1	4613.1	6402.9	7814.6	7814.6
1949-50	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	4701.4	7078.5	7814.6
1950-51	=	=	=	=	=	=	6150.8	4381.2	3501.4	3501.4	6110.5	7814.6	7814.6
1951-52	=	=	=	=	=	=	6150.8	4381.2	4381.2	4381.2	6551.6	7814.6	7814.6
1952-53	=	=	=	=	=	=	6982.7	5424.8	4688.8	4688.8	4761.9	7814.6	7814.6
1953-54	=	=	=	=	=	=	6211.3	5313.9	4608.1	4608.1	6100.4	7814.6	7814.6
1954-55	=	=	=	=	=	=	6443.3	6634.8	6433.2	5409.7	5437.4	7688.5	7814.6
1955-56	=	=	=	=	=	=	6150.8	4381.2	3501.4	3501.4	5457.6	7310.4	7814.6
1956-57	=	=	=	=	=	=	6150.8	5313.9	4608.1	4618.2	6750.8	7814.6	7814.6
1957-58	=	=	=	=	=	=	6191.2	5384.5	4638.3	4638.3	5984.5	7814.6	7814.6

TABLE 8

COLUMBIA RIVER TREATY
COMPOSITE UPPER RULE CURVE
FOR THE WHOLE OF CANADIAN STORAGE
END OF MONTH CONTENTS IN KSFD
1974-75 OPERATING YEAR 1/ 2/

FLOW YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
1928-29	7814.6	7814.6	7814.6	7814.6	7814.6	7658.3	6579.4	6680.2	6957.5	6932.3	7121.4	7814.6	7814.6
1929-30	=	=	=	=	=	=	6342.4	6292.0	5495.4	6644.9	7128.9	7814.6	7814.6
1930-31	=	=	=	=	=	=	6796.2	6831.5	6881.9	6866.8	7088.6	7814.6	7814.6
1931-32	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	5596.3	7814.6	7814.6
1932-33	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	5596.3	7612.9	7814.6
1933-34	=	=	=	=	=	=	6150.8	4381.2	4381.2	5087.0	6826.4	7814.6	7814.6
1934-35	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	5760.1	7814.6	7814.6
1935-36	=	=	=	=	=	=	6897.0	5898.8	4688.8	4688.8	5855.9	7814.6	7814.6
1936-37	=	=	=	=	=	=	6997.8	6927.3	6387.8	6846.6	7023.0	7814.6	7814.6
1937-38	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	5016.5	7814.6	7814.6
1938-39	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	5858.4	7814.6	7814.6
1939-40	=	=	=	=	=	=	6201.3	6271.8	4729.1	4759.3	5908.8	7814.6	7814.6
1940-41	=	=	=	=	=	=	6150.8	5414.8	4729.1	6871.8	7093.6	7739.0	7814.6
1941-42	=	=	=	=	=	=	6150.8	5313.9	4719.0	6735.7	7098.7	7814.6	7814.6
1942-43	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	4688.8	7814.6	7814.6
1943-44	=	=	=	=	=	=	6665.1	6796.2	6866.8	6866.8	7088.6	7562.5	7814.6
1944-45	=	=	=	=	=	=	6695.3	6518.9	6271.8	5263.5	5341.6	7814.6	7814.6
1945-46	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	5656.8	7814.6	7814.6
1946-47	=	=	=	=	=	=	6150.8	5313.9	4608.1	4633.3	5424.8	7814.6	7814.6
1947-48	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	5624.0	7814.6	7814.6
1948-49	=	=	=	=	=	=	6150.8	5414.8	4608.1	4613.1	6402.9	7814.6	7814.6
1949-50	=	=	=	=	=	=	6150.8	5313.9	4608.1	4608.1	4701.4	7078.5	7814.6
1950-51	=	=	=	=	=	=	6150.8	4381.2	3052.3	2497.7	5863.1	7814.6	7814.6
1951-52	=	=	=	=	=	=	6150.8	4381.2	4381.2	4381.2	6551.6	7814.6	7814.6
1952-53	=	=	=	=	=	=	6982.7	5424.8	4688.8	4688.8	4761.9	7814.6	7814.6
1953-54	=	=	=	=	=	=	6211.3	5313.9	4608.1	4608.1	6100.4	7814.6	7814.6
1954-55	=	=	=	=	=	=	6443.1	6634.8	6433.2	5409.7	5437.4	7688.5	7814.6
1955-56	=	=	=	=	=	=	6150.8	4381.2	3052.3	2497.7	5457.6	7310.4	7814.6
1956-57	=	=	=	=	=	=	6150.8	5313.9	4608.1	4618.2	6750.8	7814.6	7814.6
1957-58	=	=	=	=	=	=	6191.2	5384.5	4638.3	4638.3	5984.5	7814.6	7814.6

TABLE 9

COLUMBIA RIVER TREATY
COMPOSITE OPERATING RULE CURVE FOR 1969-70 OPERATING YEAR
FOR THE WHOLE OF CANADIAN STORAGE
END OF MONTH CONTENTS IN KSFD

FLOW YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
1928-29	4313.7	4211.4	3996.2	3547.2	2612.1	1339.6	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1929-30	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1930-31	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1931-32	=	=	=	=	=	=	10.5	10.0	35.9	74.6	1499.6	3071.5	4313.7
1932-33	=	=	=	=	=	=	102.6	19.9	46.3	70.2	1502.3	3051.8	4313.7
1933-34	=	=	=	=	=	=	0.0	0.0	38.4	96.5	1472.1	3071.5	4313.7
1934-35	=	=	=	=	=	=	20.4	0.0	0.0	22.7	1414.1	3026.4	4313.7
1935-36	=	=	=	=	=	=	102.6	108.7	117.8	179.5	1509.9	3071.5	4313.7
1936-37	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1937-38	=	=	=	=	=	=	0.0	0.0	0.0	22.7	1374.4	3040.9	4313.7
1938-39	=	=	=	=	=	=	25.8	0.0	39.9	98.9	1512.4	3071.5	4313.7
1939-40	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1940-41	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1941-42	=	=	=	=	=	=	36.1	76.1	117.8	224.2	1561.0	3071.5	4313.7
1942-43	=	=	=	=	=	=	75.2	50.6	76.1	98.9	1187.9	3071.5	4313.7
1943-44	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1944-45	=	=	=	=	=	=	102.6	108.7	117.8	189.2	1449.4	3071.5	4313.7
1945-46	=	=	=	=	=	=	67.3	20.9	0.0	22.7	1443.2	3071.5	4313.7
1946-47	=	=	=	=	=	=	102.6	37.3	53.2	124.1	1561.0	3071.5	4313.7
1947-48	=	=	=	=	=	=	102.6	76.1	41.8	98.9	1498.5	3071.5	4313.7
1948-49	=	=	=	=	=	=	102.6	108.7	76.1	103.9	1552.7	3071.5	4313.7
1949-50	=	=	=	=	=	=	102.6	76.1	76.1	98.9	1200.5	3021.6	4313.7
1950-51	=	=	=	=	=	=	0.0	0.0	0.0	22.7	1390.2	3062.0	4313.7
1951-52	=	=	=	=	=	=	51.5	0.0	0.0	59.7	1449.4	3071.5	4313.7
1952-53	=	=	=	=	=	=	102.6	108.7	117.8	179.5	1261.0	3071.5	4313.7
1953-54	=	=	=	=	=	=	102.6	76.1	47.3	75.5	1478.0	3071.5	4313.7
1954-55	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1444.3	3071.5	4313.7
1955-56	=	=	=	=	=	=	34.7	0.0	0.0	22.7	1424.6	3071.5	4313.7
1956-57	=	=	=	=	=	=	102.6	76.1	0.0	33.0	1489.6	3071.5	4313.7
1957-58	=	=	=	=	=	=	102.6	108.7	106.4	129.1	1561.0	3071.5	4313.7

TABLE 10

COLUMBIA RIVER TREATY
COMPOSITE OPERATING RULE CURVE FOR 1970-71 OPERATING YEAR
FOR THE WHOLE OF CANADIAN STORAGE
END OF MONTH CONTENTS IN KSFD

FLOW YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
1928-29	4313.7	4169.4	4014.6	3583.9	2651.4	1400.9	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1929-30	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1930-31	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1931-32	=	=	=	=	=	=	10.5	10.0	35.9	74.6	1499.6	3071.5	4313.7
1932-33	=	=	=	=	=	=	102.6	19.9	46.3	70.2	1502.3	3051.8	4313.7
1933-34	=	=	=	=	=	=	0.0	0.0	38.4	96.5	1472.1	3071.5	4313.7
1934-35	=	=	=	=	=	=	20.4	0.0	0.0	22.7	1414.1	3026.4	4313.7
1935-36	=	=	=	=	=	=	102.6	108.7	117.8	179.5	1509.9	3071.5	4313.7
1936-37	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1937-38	=	=	=	=	=	=	0.0	0.0	0.0	22.7	1374.4	3040.9	4313.7
1938-39	=	=	=	=	=	=	25.8	0.0	39.9	98.9	1512.4	3071.5	4313.7
1939-40	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1940-41	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1941-42	=	=	=	=	=	=	36.1	76.1	117.8	224.2	1561.0	3071.5	4313.7
1942-43	=	=	=	=	=	=	75.2	50.6	76.1	98.9	1187.9	3071.5	4313.7
1943-44	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1944-45	=	=	=	=	=	=	102.6	108.7	117.8	189.2	1449.4	3071.5	4313.7
1945-46	=	=	=	=	=	=	67.3	20.9	0.0	22.7	1443.2	3071.5	4313.7
1946-47	=	=	=	=	=	=	102.6	37.3	53.2	124.1	1561.0	3071.5	4313.7
1947-48	=	=	=	=	=	=	102.6	76.1	41.8	98.9	1498.5	3071.5	4313.7
1948-49	=	=	=	=	=	=	102.6	108.7	76.1	103.9	1552.7	3071.5	4313.7
1949-50	=	=	=	=	=	=	102.6	76.1	76.1	98.9	1200.5	3021.6	4313.7
1950-51	=	=	=	=	=	=	0.0	0.0	0.0	22.7	1390.2	3062.0	4313.7
1951-52	=	=	=	=	=	=	51.5	0.0	0.0	59.7	1449.4	3071.5	4313.7
1952-53	=	=	=	=	=	=	102.6	108.7	117.8	179.5	1261.0	3071.5	4313.7
1953-54	=	=	=	=	=	=	102.6	76.1	47.3	75.5	1478.0	3071.5	4313.7
1954-55	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1444.3	3071.5	4313.7
1955-56	=	=	=	=	=	=	34.7	0.0	0.0	22.7	1424.6	3071.5	4313.7
1956-57	=	=	=	=	=	=	102.6	76.1	0.0	33.0	1489.6	3071.5	4313.7
1957-58	=	=	=	=	=	=	102.6	108.7	106.4	129.1	1561.0	3071.5	4313.7

TABLE 11

COLUMBIA RIVER TREATY

COMPOSITE OPERATING RULE CURVE FOR 1971-72 OPERATING YEAR

FOR THE WHOLE OF CANADIAN STORAGE

END OF MONTH CONTENTS IN KSFD

FLOW YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
1928-29	4313.7	4139.5	3659.0	3348.3	2518.2	1327.7	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1929-30	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1930-31	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1931-32	=	=	=	=	=	=	10.5	10.0	35.9	74.6	1499.6	3071.5	4313.7
1932-33	=	=	=	=	=	=	102.6	19.9	46.3	70.2	1502.3	3051.8	4313.7
1933-34	=	=	=	=	=	=	0.0	0.0	38.4	96.5	1472.1	3071.5	4313.7
1934-35	=	=	=	=	=	=	20.4	0.0	0.0	22.7	1414.1	3026.4	4313.7
1935-36	=	=	=	=	=	=	102.6	108.7	117.8	179.5	1509.9	3071.5	4313.7
1936-37	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1937-38	=	=	=	=	=	=	0.0	0.0	0.0	22.7	1374.4	3040.9	4313.7
1938-39	=	=	=	=	=	=	25.8	0.0	39.9	98.9	1512.4	3071.5	4313.7
1939-40	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1940-41	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1941-42	=	=	=	=	=	=	36.1	76.1	117.8	224.2	1561.0	3071.5	4313.7
1942-43	=	=	=	=	=	=	75.2	50.6	76.1	98.9	1187.9	3071.5	4313.7
1943-44	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1561.0	3071.5	4313.7
1944-45	=	=	=	=	=	=	102.6	108.7	117.8	189.2	1449.4	3071.5	4313.7
1945-46	=	=	=	=	=	=	67.3	20.9	0.0	22.7	1443.2	3071.5	4313.7
1946-47	=	=	=	=	=	=	102.6	37.3	53.2	124.1	1561.0	3071.5	4313.7
1947-48	=	=	=	=	=	=	102.6	76.1	41.8	98.9	1498.5	3071.5	4313.7
1948-49	=	=	=	=	=	=	102.6	108.7	76.1	103.9	1552.7	3071.5	4313.7
1949-50	=	=	=	=	=	=	102.6	76.1	76.1	98.9	1200.5	3021.6	4313.7
1950-51	=	=	=	=	=	=	0.0	0.0	0.0	22.7	1390.2	3062.0	4313.7
1951-52	=	=	=	=	=	=	51.5	0.0	0.0	59.7	1449.4	3071.5	4313.7
1952-53	=	=	=	=	=	=	102.6	108.7	117.8	179.5	1261.0	3071.5	4313.7
1953-54	=	=	=	=	=	=	102.6	76.1	47.3	75.5	1478.0	3071.5	4313.7
1954-55	=	=	=	=	=	=	102.6	108.7	117.8	224.2	1444.3	3071.5	4313.7
1955-56	=	=	=	=	=	=	34.7	0.0	0.0	22.7	1424.6	3071.5	4313.7
1956-57	=	=	=	=	=	=	102.6	76.1	0.0	33.0	1489.6	3071.5	4313.7
1957-58	=	=	=	=	=	=	102.6	108.7	106.4	129.1	1561.0	3071.5	4313.7

TABLE 12

COLUMBIA RIVER TREATY
COMPOSITE OPERATING RULE CURVE FOR 1972-73 OPERATING YEAR 1/
FOR THE WHOLE OF CANADIAN STORAGE
END OF MONTH CONTENTS IN KSFD

FLOW YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
1928-29	4313.7	4213.0	3846.9	3620.6	3091.7	2504.6	1371.5	1882.4	1226.4	971.2	3243.2	5780.0	7814.6
1929-30	=	=	=	=	=	=	232.4	722.9	197.1	451.3	2832.8	5780.0	7814.6
1930-31	=	=	=	=	=	=	2022.9	1882.4	1226.4	971.2	3243.2	5780.0	7814.6
1931-32	=	=	=	=	=	=	10.5	10.0	35.9	51.8	2620.6	5740.9	7814.6
1932-33	=	=	=	=	=	=	113.6	19.9	46.3	47.5	1784.0	5694.9	7814.6
1933-34	=	=	=	=	=	=	0.0	0.0	.5	.5	723.1	5552.7	7814.6
1934-35	=	=	=	=	=	=	20.4	0.0	0.0	0.0	960.3	5160.8	7814.6
1935-36	=	=	=	=	=	=	788.8	582.1	450.3	554.0	2709.4	5780.0	7814.6
1936-37	=	=	=	=	=	=	2081.3	1882.4	1226.4	971.2	3243.2	5780.0	7814.6
1937-38	=	=	=	=	=	=	0.0	0.0	0.0	305.1	1807.2	5592.6	7814.6
1938-39	=	=	=	=	=	=	681.3	508.6	145.6	405.2	2837.7	5780.0	7814.6
1939-40	=	=	=	=	=	=	1388.1	1862.2	1226.4	971.2	3243.2	5780.0	7814.6
1940-41	=	=	=	=	=	=	868.5	1094.8	1226.4	737.2	3243.2	5780.0	7814.6
1941-42	=	=	=	=	=	=	200.6	1292.2	1216.4	965.1	3243.2	5780.0	7814.6
1942-43	=	=	=	=	=	=	509.7	899.6	1082.5	503.0	2131.2	5780.0	7814.6
1943-44	=	=	=	=	=	=	2081.3	1882.4	1226.4	971.2	3243.2	5780.0	7814.6
1944-45	=	=	=	=	=	=	1709.5	1814.7	1226.4	936.2	2949.9	5780.0	7814.6
1945-46	=	=	=	=	=	=	542.0	20.9	0.0	0.0	1616.5	5706.7	7814.6
1946-47	=	=	=	=	=	=	345.4	100.9	53.2	265.3	2607.9	5780.0	7814.6
1947-48	=	=	=	=	=	=	1144.5	1527.2	485.4	670.9	2407.6	5780.0	7814.6
1948-49	=	=	=	=	=	=	1276.0	1862.2	1105.4	890.8	3234.9	5780.0	7814.6
1949-50	=	=	=	=	=	=	1361.9	1173.4	822.6	649.8	2115.1	5699.0	7814.6
1950-51	=	=	=	=	=	=	63.3	0.0	0.0	0.0	1932.5	5600.4	7814.6
1951-52	=	=	=	=	=	=	635.8	381.9	324.8	494.1	3009.7	5780.0	7814.6
1952-53	=	=	=	=	=	=	2081.3	1344.0	1186.1	966.4	2364.3	5780.0	7814.6
1953-54	=	=	=	=	=	=	1789.1	1000.5	47.3	381.9	2034.2	5565.9	7814.6
1954-55	=	=	=	=	=	=	1249.4	1642.6	1216.4	971.2	3045.7	5757.0	7814.6
1955-56	=	=	=	=	=	=	34.7	0.0	0.0	0.0	1770.4	5780.0	7814.6
1956-57	=	=	=	=	=	=	121.6	79.7	0.0	126.4	2586.6	5780.0	7814.6
1957-58	=	=	=	=	=	=	1418.8	1140.8	1063.2	875.4	3243.2	5780.0	7814.6

TABLE 13

COLUMBIA RIVER TREATY
COMPOSITE OPERATING RULE CURVE FOR 1973-74 OPERATING YEAR 1/
FOR THE WHOLE OF CANADIAN STORAGE
END OF MONTH CONTENTS IN KSFD

FLOW YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
1928-29	7814.6	7674.3	6879.0	6493.9	6513.7	6612.3	1371.5	2166.5	1977.5	1360.5	3243.1	5780.0	7814.6
1929-30	"	"	"	"	"	"	697.5	852.4	457.3	451.3	2832.7	5780.0	7814.6
1930-31	"	"	"	"	"	"	1990.5	2185.2	1962.7	1360.5	3243.1	5780.0	7814.6
1931-32	"	"	"	"	"	"	440.9	333.6	35.9	51.8	2620.6	5740.9	7814.6
1932-33	"	"	"	"	"	"	309.8	30.0	46.3	47.5	1784.0	5694.9	7814.6
1933-34	"	"	"	"	"	"	0.0	0.0	.5	.5	723.1	5552.7	7814.6
1934-35	"	"	"	"	"	"	20.4	0.0	0.0	0.0	960.3	5160.8	7814.6
1935-36	"	"	"	"	"	"	983.6	775.5	1090.1	554.0	2709.3	5780.0	7814.6
1936-37	"	"	"	"	"	"	1875.6	2007.9	1793.9	1360.5	3243.1	5780.0	7814.6
1937-38	"	"	"	"	"	"	0.0	0.0	0.0	305.1	1807.2	5592.6	7814.6
1938-39	"	"	"	"	"	"	681.3	508.6	145.6	720.2	2837.7	5780.0	7814.6
1939-40	"	"	"	"	"	"	1308.4	1585.8	1597.1	1360.5	3243.1	5780.0	7814.6
1940-41	"	"	"	"	"	"	868.5	1059.1	1269.9	1126.5	3243.1	5780.0	7814.6
1941-42	"	"	"	"	"	"	200.6	1148.1	1558.4	1354.4	3243.1	5780.0	7814.6
1942-43	"	"	"	"	"	"	509.7	899.6	1059.6	892.3	2131.2	5780.0	7814.6
1943-44	"	"	"	"	"	"	1815.9	1738.1	1873.3	1360.5	3243.1	5780.0	7814.6
1944-45	"	"	"	"	"	"	1677.1	1817.7	1708.5	1325.5	2949.8	5780.0	7814.6
1945-46	"	"	"	"	"	"	542.0	20.9	0.0	0.0	1616.5	5706.7	7814.6
1946-47	"	"	"	"	"	"	345.4	100.9	53.2	265.3	2607.9	5780.0	7814.6
1947-48	"	"	"	"	"	"	1144.5	1527.2	485.3	905.4	2407.6	5780.0	7814.6
1948-49	"	"	"	"	"	"	1276.0	1876.0	1394.8	1280.1	3234.8	5780.0	7814.6
1949-50	"	"	"	"	"	"	1358.4	1173.4	822.6	1039.1	2115.1	5699.0	7814.6
1950-51	"	"	"	"	"	"	173.9	0.0	0.0	0.0	1932.5	5600.4	7814.6
1951-52	"	"	"	"	"	"	635.8	381.9	324.8	893.4	3009.7	5780.0	7814.6
1952-53	"	"	"	"	"	"	2786.7	1344.0	1299.9	1355.7	2364.3	5780.0	7814.6
1953-54	"	"	"	"	"	"	1756.7	1000.5	47.3	457.7	2034.2	5565.9	7814.6
1954-55	"	"	"	"	"	"	1217.0	1642.6	1703.8	1360.5	3045.6	5757.0	7814.6
1955-56	"	"	"	"	"	"	34.7	0.0	0.0	0.0	1770.4	5780.0	7814.6
1956-57	"	"	"	"	"	"	121.6	79.7	0.0	126.4	2586.6	5780.0	7814.6
1957-58	"	"	"	"	"	"	1386.4	1160.8	1063.2	1264.7	3243.1	5780.0	7814.6

TABLE III

COLUMBIA RIVER TREATY
COMPOSITE OPERATING RULE CURVE FOR 1974-75 OPERATING YEAR 1/
FOR THE WHOLE OF CANADIAN STORAGE
END OF MONTH CONTENTS IN KSFD

FLOW YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
1928-29	7814.6	7490.5	6742.3	6389.7	6455.8	5537.1	1371.5	2166.5	1938.6	1304.8	3243.1	6105.0	7814.6
1929-30	=	=	=	=	=	=	697.5	852.4	453.9	451.3	2832.7	5934.2	7814.6
1930-31	=	=	=	=	=	=	1990.5	2185.2	1923.7	1304.8	3243.1	6105.0	7814.6
1931-32	=	=	=	=	=	=	440.9	333.6	35.9	51.8	2620.6	6065.9	7814.6
1932-33	=	=	=	=	=	=	309.8	30.0	46.3	47.5	1784.0	5694.9	7814.6
1933-34	=	=	=	=	=	=	0.0	0.0	.5	.5	723.1	5552.7	7814.6
1934-35	=	=	=	=	=	=	20.4	0.0	0.0	0.0	960.3	5160.8	7814.6
1935-36	=	=	=	=	=	=	983.6	775.5	1054.6	554.0	2709.3	6105.0	7814.6
1936-37	=	=	=	=	=	=	1875.6	2007.9	1760.4	1304.8	3243.1	6105.0	7814.6
1937-38	=	=	=	=	=	=	0.0	0.0	0.0	305.1	1807.2	5917.6	7814.6
1938-39	=	=	=	=	=	=	681.3	508.6	145.6	720.2	2837.7	6105.0	7814.6
1939-40	=	=	=	=	=	=	1308.4	1585.8	1567.1	1304.8	3243.1	6105.0	7814.6
1940-41	=	=	=	=	=	=	868.5	1059.1	1239.9	1070.7	3243.1	6105.0	7814.6
1941-42	=	=	=	=	=	=	200.6	1148.1	1528.4	1298.7	3243.1	6105.0	7814.6
1942-43	=	=	=	=	=	=	509.7	899.6	1029.6	836.6	2131.2	6105.0	7814.6
1943-44	=	=	=	=	=	=	1815.9	1738.1	1839.9	1304.8	3243.1	6105.0	7814.6
1944-45	=	=	=	=	=	=	1677.1	1817.7	1705.0	1269.7	2949.8	6105.0	7814.6
1945-46	=	=	=	=	=	=	542.0	20.9	0.0	0.0	1616.5	6031.6	7814.6
1946-47	=	=	=	=	=	=	345.4	100.9	53.2	265.3	2607.9	6105.0	7814.6
1947-48	=	=	=	=	=	=	1144.5	1527.2	485.3	905.4	2407.6	6105.0	7814.6
1948-49	=	=	=	=	=	=	1276.0	1876.0	1394.8	1224.4	3234.8	6105.0	7814.6
1949-50	=	=	=	=	=	=	1358.4	1173.4	822.6	983.4	2115.1	5963.6	7814.6
1950-51	=	=	=	=	=	=	173.9	0.0	0.0	0.0	1932.5	5887.3	7814.6
1951-52	=	=	=	=	=	=	635.8	381.9	324.8	827.6	3009.7	6105.0	7814.6
1952-53	=	=	=	=	=	=	2784.7	1344.0	1299.9	1300.0	2364.3	6105.0	7814.6
1953-54	=	=	=	=	=	=	1756.7	1000.5	47.3	457.7	2034.2	5820.9	7814.6
1954-55	=	=	=	=	=	=	1217.0	1442.6	1703.8	1304.8	3045.6	6082.0	7814.6
1955-56	=	=	=	=	=	=	34.7	0.0	0.0	0.0	1770.4	6044.6	7814.6
1956-57	=	=	=	=	=	=	121.6	79.7	0.0	126.4	2586.6	6105.0	7814.6
1957-58	=	=	=	=	=	=	1384.4	1160.8	1063.2	1208.9	3243.1	6105.0	7814.6

TABLE 15

ILLUSTRATION OF DERIVATION
OF OPERATING RULE CURVE
FOR THE WHOLE OF CANADIAN TREATY STORAGE

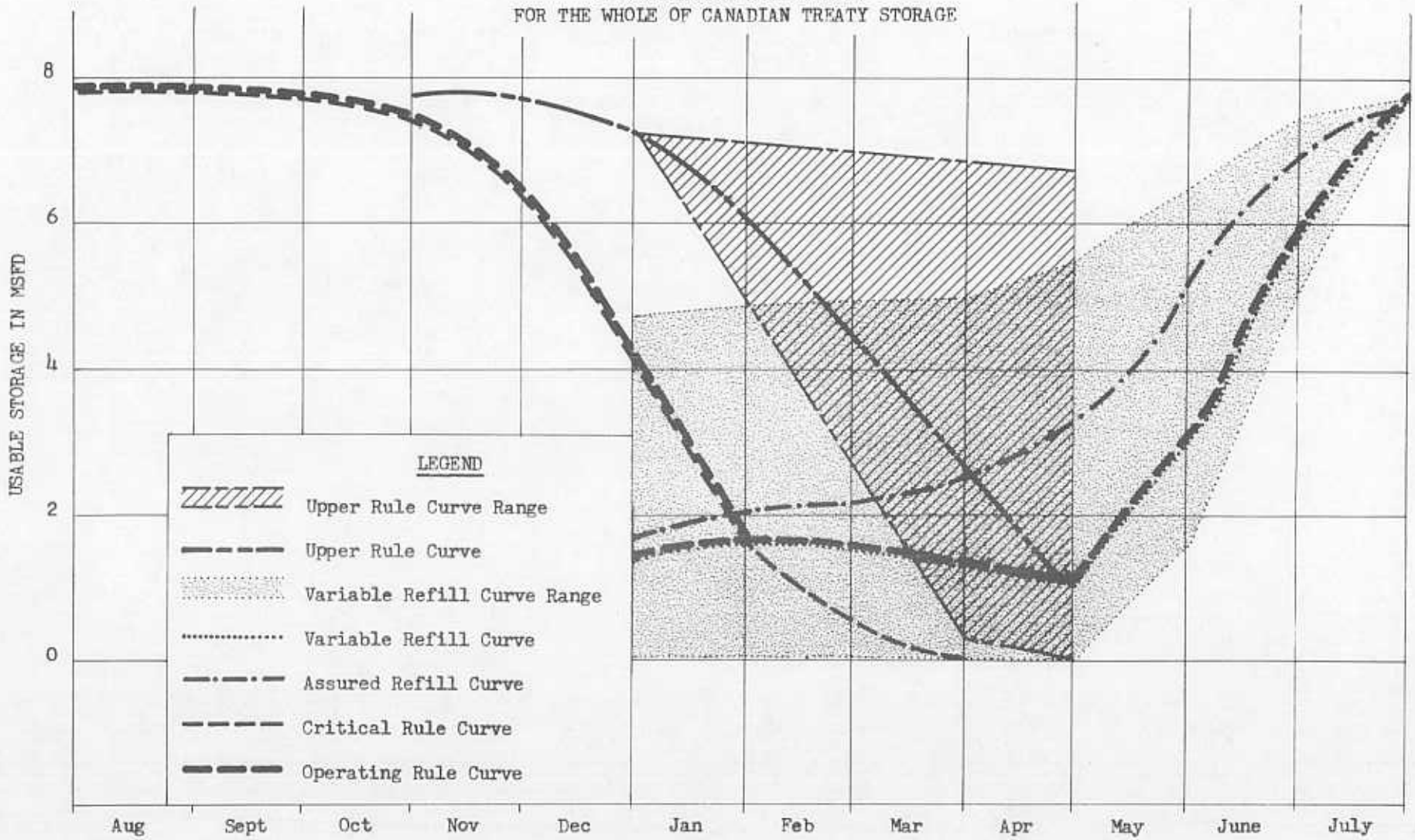

CHART 1

COLUMBIA RIVER TREATY

AGREEMENT

on

HYDROELECTRIC OPERATING PLANS FOR CANADIAN STORAGE

DURING THE OPERATING YEARS 1969-70 THROUGH 1974-75

The Canadian Entity and the United States Entity signed an agreement on 2 June 1969 and 6 June 1969 on "Columbia River Treaty Hydroelectric Operating Plans for Canadian Storage - Operating Years 1969-70 through 1974-75," dated February 15, 1969.

The Canadian Entity and the United States Entity herewith agree to an amendment of "Columbia River Treaty Hydroelectric Operating Plans for Canadian Storage - Operating Years 1969-70 through 1974-75," dated February 15, 1969, by deletion of Footnote 3 attached to the tables included in that document.

R. G. Williston
Chairman
Canadian Entity

Sept 30, 1969
(Date signed)

H. R. Richmond
Chairman
United States Entity

Sept 23 1969
(Date signed)

These footnotes apply to the following tables.

Notes

1/ The rule curves for the individual projects totaled to obtain the composite rule curves for Canadian storage consider only usable storage. The actual allowable volume in Mica in terms of storage space below full pool will be calculated in the actual operating year until such time as initial filling is completed.

2/ The Upper Rule Curve is based on the assumption of a transfer of two million acre-feet of flood control storage space from Arrow to Mica. This transfer will be determined each year in accordance with draft of Flood Control Plan dated August 12, 1968, and may not be as assumed in the studies. The composite Upper Rule Curves tabulated herein are for the sole purpose of defining the Operating Rule Curves in instances where the Upper Rule Curve provides for greater draft than the Variable Refill Curve. In the system regulation studies, individual Upper Rule Curves for each Canadian Treaty reservoir were used as an upper limit to reservoir storage content. The tabulated values of the composite Upper Rule Curves for the end of May, June, and July were taken from daily system regulation studies rather than from simulated forecasts and Flood Control Storage Reservation diagrams.

Blake

OCT 8 1969

In reply fefer to:
AD

Mr. Wendell E. Johnson
Chairman, United States Section
Permanent Engineering Board
c/o Office, Chief of Engineers
Building T-7, Room 1308
Washington, D.C. 20315

Dear Mr. Johnson:

Enclosed are three copies of an agreement, which has been signed by the United States and Canadian Entities, amending "Hydroelectric Operating Plans for Canadian Storage During the Operating Years 1969-70 through 1974-75," by deleting Footnote 3 from the tables. Enclosed are additional copies of a revised page of footnotes for your convenience.

Sincerely,

(SGD) H. R. RICHMOND

H. R. Richmond
Chairman
United States Entity

Enclosures

cc:
Division Engineer, Corps of Engineers
Morgan D. Dubrow, Washington, D.C.
W. D. Kennedy, B. C. Hydro
G. H. Fernald, Jr., C of E
B. Goldhammer - P
G. W. Toman - AC
H. M. McIntyre - PR
F. A. Limpert - PRH
Adm. Chron. File - A
Secretary, U.S. Entity - AD

AD:HKropitzer:vn 9-29-69