

**ANNUAL REPORT
to the
GOVERNMENTS
of
THE UNITED STATES and CANADA**

**COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD**

Washington, D.C.

Ottawa, Ontario

30 September 2002



COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD

C A N A D A • U N I T E D S T A T E S

CANADIAN SECTION

D.R. WHELAN, Chairman
J. D. Ebbels, Member

UNITED STATES SECTION

S.L. STOCKTON, Chairman
R.H. Wilkerson, Member

28 February 2003

The Honorable Colin Powell
Secretary of State
Washington, D.C.

The Honourable Herb Dhaliwal
Minister of Natural Resources
Ottawa, Ontario

Dear Secretary Powell and Minister Dhaliwal:

We refer you to the Treaty between the United States of America and Canada relating to cooperative development of the water resources of the Columbia River basin, signed at Washington, D.C., on 17 January 1961.

In accordance with the provisions of Article XV, paragraph 2(e), we are submitting the thirty-eighth Annual Report of the Permanent Engineering Board, dated 30 September 2002. The report documents the results achieved under the Treaty from 1 October 2001 to 30 September 2002.

The requirements of the Treaty have generally been met. However, the Board notes that the Assured Operating Plans (AOPs) and Determinations of Downstream Power Benefits (DDPBs) for operating years 2006–2007 and 2007–2008 have not been prepared on a timely basis, in accordance with paragraph 9 of Annex A of the Treaty. This paragraph requires the Entities to prepare an AOP and the associated DDPB for the sixth succeeding year of operation. The Board recognizes that this delay is due to the efforts of the Entities to update the study process. Since the Entities plan to complete these documents in the next reporting year, this delay will not have any impact on Treaty operations.

Respectfully submitted:

For the United States

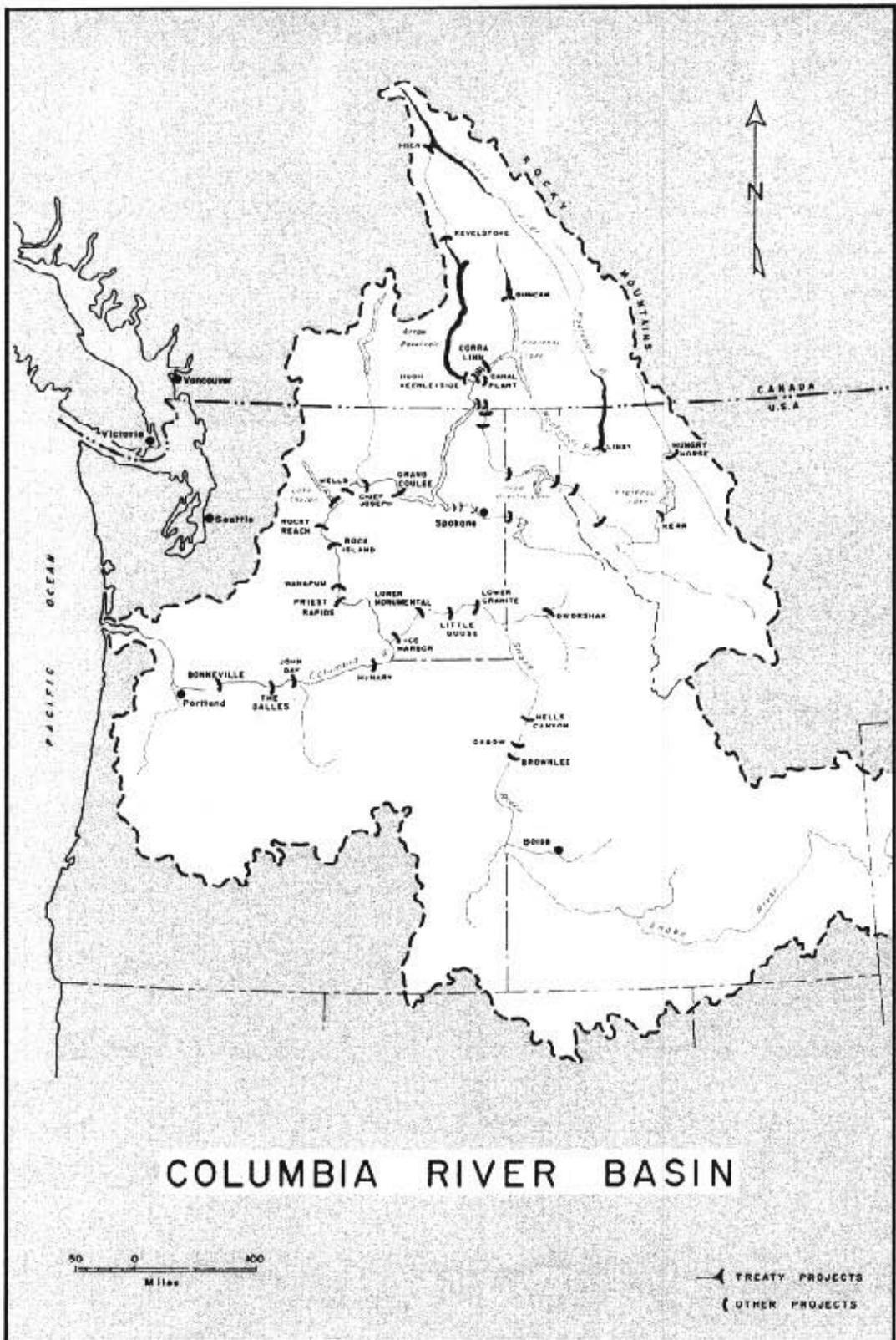
For Canada

Steven Stockton, Chair

Dan Whelan, Chair

Ronald Wilkerson

Jack Ebbels



COLUMBIA RIVER BASIN

50 0 100
Miles

→ TREATY PROJECTS
(OTHER PROJECTS

Cat. No. M1-14/2002E
ISBN 0-662-78091-4

© Her Majesty the Queen in Right of Canada, 2004



Recycled Paper

TABLE OF CONTENTS

Letter of Transmittal	
SUMMARY	vi
INTRODUCTION	1
THE COLUMBIA RIVER TREATY	3
General	3
Features of the Treaty and Related Documents	3
PERMANENT ENGINEERING BOARD	5
General	5
Establishment of the Board	5
Duties and Responsibilities	5
ENTITIES	8
General	8
Establishment of the Entities	8
Powers and Duties of the Entities	8
ACTIVITIES OF THE BOARD	10
Meetings	10
Reports Received	10
Report to the Governments	12
TREATY IMPLEMENTATION	14
General	14
Status of the Treaty Projects	14
Duncan Project	14
Arrow Project	15
Mica Project	15
Libby Project in the United States	16
Libby Project in Canada	16
Hydrometeorological Network	16
Power Operating Plans and Calculation of Downstream Power Benefits	17
Transmission Developments	19
Flood Control Operating Plans	19
Flow Records	20
Non-Treaty Storage	20
Operations for Fish	20

OPERATION	22
General	22
Power Operation	25
Mica Project	27
Arrow Project	27
Duncan Project	27
Libby Project	27
Flood Control Operation	28
Duncan Reservoir Levels	29
Mica Reservoir Levels	30
Libby Reservoir Levels	31
Arrow Reservoir Levels	32
Observed and Pre-Project Flows:	
Libby Dam	33
Duncan Dam	34
Mica Dam	35
Hugh Keenleyside Dam	36
Birchbank	37
BENEFITS	38
Flood Control Benefits	38
Power Benefits	38
Other Benefits	40
CONCLUSIONS	41
 LIST OF PHOTOGRAPHS	
Libby Dam	2
Hugh Keenleyside Dam	7
Duncan Dam	13
Mica Dam	21

Photographs supplied by the British Columbia Hydro and Power Authority and the U.S. Army Corps of Engineers

LIST OF HYDROGRAPHS

Duncan Reservoir Levels	29
Mica Reservoir Levels	30
Libby Reservoir Levels	31
Arrow Reservoir Levels	32
Observed and Pre-Project Flows:	
Libby Dam	33
Duncan Dam	34
Mica Dam	35
Hugh Keenleyside Dam	36
Birchbank	37

APPENDICES

Appendix A. <i>Columbia River Treaty</i> Permanent Engineering Board	43
Appendix B. <i>Columbia River Treaty</i> Entities	47
Appendix C. Record of Flows at the International Boundary	49
Appendix D. Project Information	53

SUMMARY

The thirty-eighth Annual Report of the Permanent Engineering Board is submitted to the governments of the United States and Canada in compliance with Article XV of the *Columbia River Treaty* of 17 January 1961. This report describes the status of projects; the progress of Entity studies; the operation of the Duncan, Arrow, Mica and Libby reservoirs; and the resulting benefits, from 1 October 2001 to 30 September 2002.

As reported in this document, the requirements of the Treaty have generally been satisfied. However, the Assured Operating Plans (AOPs) and Determinations of Downstream Power Benefits (DDPBs) for 2006–2007 and 2007–2008 have not been received. Since the Entities plan to complete these reports in the next reporting year, this will not have any impact on Treaty operations.

The entitlement to the downstream power benefits accruing to each country from the Treaty storage for the operating year 1 August 2001 through 31 July 2002 was determined, according to the procedures set out in the Treaty and Protocol, to be 532.6 average megawatts (aMW) of energy and 1427.1 megawatts (MW) of capacity.

From 1 August 2001 through 31 July 2002, the U.S. Entity delivery of the Canadian entitlement to downstream power benefits, attributed to Duncan and Arrow projects, was 292.1 aMW of energy at rates up to 782.6 MW of capacity. No entitlement power was disposed of in the United States during that period.

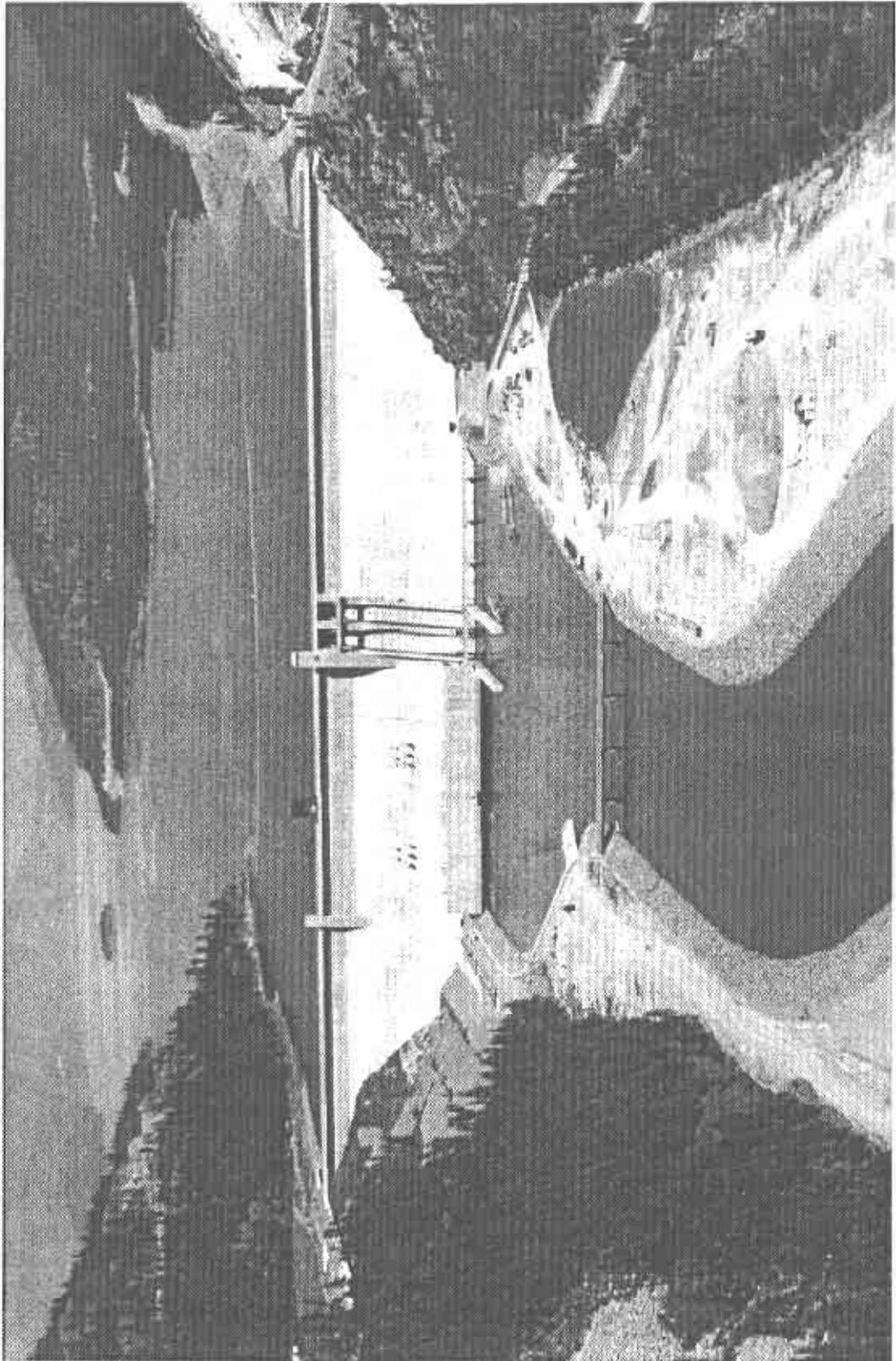
The Duncan, Arrow and Mica projects were operated in conformity with the Treaty during the 2001–2002 operating year. The operation reflected detailed operating plans developed by the Entities, the flood control operating plan for Treaty reservoirs and other agreements between the Entities. The reporting year was characterized by the return to normal flow conditions in the Columbia River basin. There was no significant flooding within the basin.

The Entities continued to operate the hydrometeorological network as required by the Treaty. The Hydrometeorological Committee prepared an annual report documenting the system according to the updated process adopted in the previous reporting year.

INTRODUCTION

The *Columbia River Treaty* provides for the cooperative development of the water resources of the Columbia River basin. Article XV of the Treaty established the Permanent Engineering Board and specified that one of its duties is to "make reports to Canada and the United States of America at least once a year of the results being achieved under the Treaty."

This Annual Report, which covers 1 October 2001 through 30 September 2002, describes the activities of the Board, the progress being achieved by both countries under the terms of the Treaty, the operation of the Treaty projects and the resulting benefits. Summaries of the essential features of the Treaty and of the responsibilities of the Board and the Entities are included. The report refers to items currently under review by the Entities, discusses the operations of the Treaty reservoirs and the resulting power and flood control benefits, and presents the conclusions of the Board.



**Libby Dam and Lake Koocanusa – Kootenai River, Montana
The dam and reservoir, Lake Koocanusa, with the powerhouse at the left of the spillway**

THE COLUMBIA RIVER TREATY

General

The *Columbia River Treaty* was signed in Washington, D.C., on 17 January 1961 and was ratified by the United States Senate in March that year. In Canada, ratification was delayed. Further negotiations between the two countries resulted in a formal agreement by an exchange of notes on 22 January 1964 to a Protocol to the Treaty and to an Attachment Relating to Terms of Sale. The Parliament of Canada approved the Treaty and related documents in June 1964.

The Canadian Entitlement Purchase Agreement was signed on 13 August 1964. Under the terms of this agreement, Canada's share of downstream power benefits resulting from the first 30 years of scheduled operation of each of the storage projects was sold to a group of electric utilities in the United States known as the Columbia Storage Power Exchange.

On 16 September 1964, the Treaty and Protocol were formally ratified by an exchange of notes between the two governments. The sum of US\$253.9 million was delivered to the Canadian representatives as payment in advance for the Canadian entitlement to downstream power benefits during the period of the Purchase Agreement. On the same date, at a ceremony at Peace Arch Park on the International Boundary, the Treaty and its Protocol were proclaimed by President Johnson of the United States, Prime Minister Pearson of Canada and Premier Bennett of British Columbia.

Features of the Treaty and Related Documents

The essential undertakings of the Treaty are as follows:

- (a) Canada will provide 19.1 cubic kilometres (15.5 million acre-feet) of usable storage by constructing dams near Mica Creek, the outlet of Arrow lakes and Duncan Lake in British Columbia.
- (b) The United States will maintain and operate hydroelectric power facilities included in the base system and any new main-stem projects to make the most effective use of improved stream flow resulting from operation of the Canadian storage. Canada will operate the storage in accordance with procedures and operating plans specified in the Treaty.
- (c) The United States and Canada will share equally the additional power benefit available in the United States as a result of river regulation by upstream storage in Canada.

- (d) On commencement of the respective storage operations, the United States will make payments to Canada totaling US\$64.4 million for flood control provided by Canada.
- (e) The United States has the option of constructing a dam on the Kootenai River near Libby, Montana. The Libby reservoir would extend some 67.6 kilometres (42 miles) into Canada, and Canada would make the necessary Canadian land available for flooding.
- (f) Both Canada and the United States have the right to make diversions of water for consumptive uses and, in addition, after September 1984 Canada has the option of making for power purposes specific diversions of the Kootenay River into the headwaters of the Columbia River.
- (g) Differences arising under the Treaty that cannot be resolved by the two countries may be referred by either country to the International Joint Commission or to arbitration by an appropriate tribunal as specified by the Treaty.
- (h) The Treaty shall remain in force for at least 60 years from its date of ratification, 16 September 1964.

The Protocol of January 1964 amplified and clarified certain terms of the *Columbia River Treaty*. The Attachment Relating to Terms of Sale signed on the same date established agreement that under certain terms Canada would sell in the United States its entitlement to downstream power benefits for a 30-year period. The Exchange of Notes and Attachment Relating to Terms of Sale of January 1964 and the Canadian Entitlement Purchase Agreement of 13 August 1964 (the Sales Agreement) provided that the Treaty storage would be operative for power purposes on the following dates: Duncan storage on 1 April 1968; Arrow storage on 1 April 1969; and Mica storage on 1 April 1973.

PERMANENT ENGINEERING BOARD

General

Article XV of the *Columbia River Treaty* established a Permanent Engineering Board consisting of two members to be appointed by Canada and two members to be appointed by the United States. Appointments to the Board were to be made within three months of the date of ratification. The duties and responsibilities of the Board were also stipulated in the Treaty and related documents.

Establishment of the Board

Pursuant to Executive Order No. 11177 dated 16 September 1964, the Secretary of the Army and the Secretary of the Interior, on 7 December 1964, each appointed a member and an alternate member to form the United States Section of the Permanent Engineering Board. Pursuant to the *Department of Energy Organization Act* of 4 August 1977, the appointments to the United States Section of the Board are now made by the Secretary of the Army and the Secretary of Energy. The members of the Canadian Section of the Board were appointed by Order in Council P.C. 1964-1671 dated 29 October 1964. Each Canadian member was authorized to appoint an alternate member. On 11 December 1964, the two governments announced the composition of the Board.

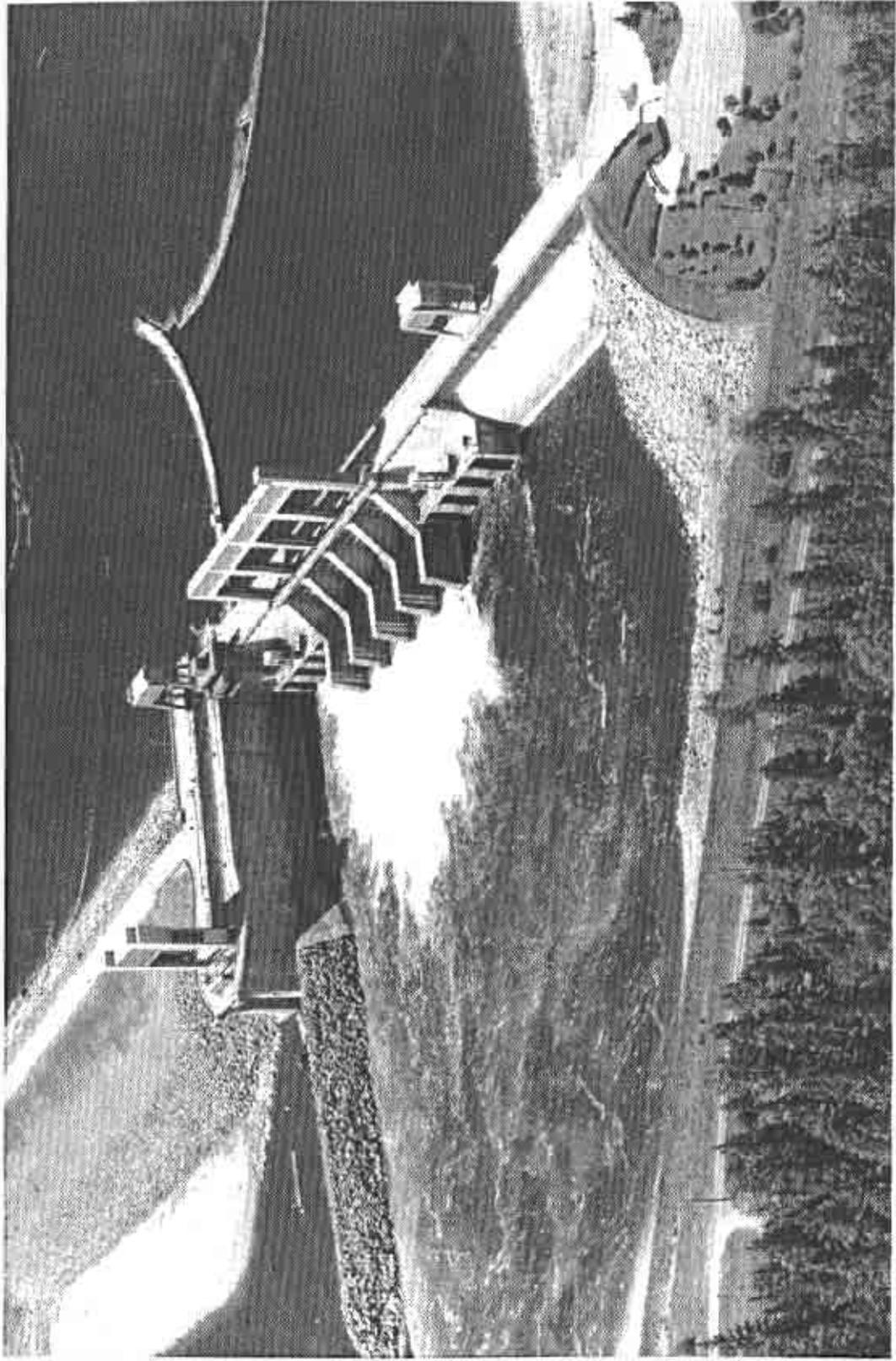
The names of Board members, alternate members and secretaries are shown in Appendix A. The names of the current members of the Board's Engineering Committee are also shown.

Duties and Responsibilities

The general duties and responsibilities of the Board to the governments, as set forth in Article XV(2) of the Treaty and related documents, include

- (a) assembling records of the flows of the Columbia River and the Kootenay River at the Canada-United States of America boundary;
- (b) reporting to Canada and the United States of America whenever there is substantial deviation from the hydroelectric and flood control operating plans and, if appropriate, including in the report recommendations for remedial action and compensatory adjustments;
- (c) assisting in reconciling differences concerning technical or operational matters that may arise between the Entities;

- (d) making periodic inspections and requiring reports as necessary from the Entities with a view to ensuring that the objectives of the Treaty are being met;
- (e) making reports to Canada and the United States at least once a year of the results being achieved under the Treaty and making special reports concerning any matter that it considers should be brought to their attention;
- (f) investigating and reporting with respect to any other matter coming within the scope of the Treaty at the request of either Canada or the United States; and
- (g) consulting with the Entities in the establishment and operation of a hydrometeorological system as required by Annex A of the Treaty.



Hugh Keenleyside Dam (Arrow Lakes) – Columbia River, British Columbia
Concrete spillway and discharge works with navigation lock and earth dam

ENTITIES

General

Article XIV(1) of the Treaty provides that Canada and the United States of America shall each designate one or more Entities to formulate and execute the operating arrangements necessary to implement the Treaty. The powers and duties of the Entities are specified in the Treaty and its related documents.

Establishment of the Entities

Executive Order No. 11177, previously referred to, designated the Administrator of the Bonneville Power Administration, the Department of the Interior and the Division Engineer, North Pacific Division, Corps of Engineers, Department of the Army, as the United States Entity with the Administrator to serve as Chair. Pursuant to the *Department of Energy Organization Act* of 4 August 1977, the Bonneville Power Administration was transferred to the Department of Energy. Order in Council P.C. 1964-1407, dated 4 September 1964, designated the British Columbia Hydro and Power Authority as the Canadian Entity.

The names of the members of the Entities are shown in Appendix B.

Powers and Duties of the Entities

In addition to the powers and duties specified elsewhere in the Treaty and related documents, Article XIV(2) of the Treaty requires that the Entities be responsible for the following:

- (a) coordination of plans and exchange of information relating to facilities to be used in producing and obtaining the benefits contemplated by the Treaty;
- (b) calculation of and arrangements for delivery of hydroelectric power to which Canada is entitled for providing flood control;
- (c) calculation of the amounts payable to the United States for standby transmission services;
- (d) consultation on requests for variations made pursuant to articles XII(5) and XIII(6);
- (e) the establishment and operation of a hydrometeorological system as required by Annex A;
- (f) assistance to and cooperation with the Permanent Engineering Board in the discharge of its functions;

- (g) periodic calculation of accounts;
- (h) preparation of the hydroelectric operating plans and the flood control operating plans for the Canadian storage together with determination of the downstream power benefits to which Canada is entitled;
- (i) preparation of proposals to implement Article VIII and carrying out any disposal authorized or exchange provided for therein;
- (j) making appropriate arrangements for delivery to Canada of the downstream power benefits to which Canada is entitled, including such matters as load factors for delivery, times and points of delivery, and calculation of transmission loss; and
- (k) preparation and implementation of detailed operating plans that may produce results more advantageous to both countries than those that would arise from operation under the plans referred to in annexes A and B.

Article XIV(4) of the Treaty provides that the two governments may, by an exchange of notes, empower or charge the Entities with any other matter coming within the scope of the Treaty.

ACTIVITIES OF THE BOARD

Meetings

The Board held its 69th meeting on 13 March 2002 in Portland, Oregon. In conjunction with this meeting, the Board also held its 50th joint meeting with the Entities.

At this meeting, topics included the status of Assured Operating Plans (AOPs) and Determinations of Downstream Power Benefits (DDPBs), transmission issues and return of the Canadian entitlement, the impacts of U.S. resource agencies' Biological Opinions on Treaty operations, the implications of power deregulation on the Treaty and a proposal to streamline Entity study processes.

Reports Received

Throughout the report year, the Entities maintained contact with the Board and its Engineering Committee. Information pertinent to the operation of Treaty storage projects was made available to the Board.

The following documents involving the operation of *Columbia River Treaty* storage have been received by the Board from the Entities since the last Annual Report:

- *Columbia River Treaty* Entity Agreement Relating to Extension of the Expiration Date of the Non-Treaty Storage Agreement, signed 28 June 2002.

This agreement between the Entities extends the use of Columbia River non-Treaty storage, Mica and Arrow refill enhancements, and the initial filling of non-Treaty storage to 24:00 on 30 June 2004.

- *Columbia River Treaty* Entity Agreement on the Detailed Operating Plan for Columbia River Storage for 1 August 2002 through 31 July 2003, signed 22 July 2002.

This agreement between the Entities implements the detailed operating plan (DOP) for Columbia River storage during 1 August 2002 through 31 July 2003.

- *Columbia River Treaty* Operating Committee Agreement on Operation of Treaty Storage for Non-Power Uses for 1 January 2002 through 31 July 2002, signed 7 February 2002.

This agreement is similar to previous agreements implemented to utilize Treaty storage for non-power uses. These uses include (1) providing flows for Canadian trout spawning for April through June, (2) enhancing the capability in the United States of providing spring and summer flow augmentation for salmon and

steelhead by storing 1 million acre-feet of water in Arrow by late April, (3) enhancing Arrow lake levels by ensuring progressive refill, (4) providing a minimum discharge objective at Arrow during February and March 2002 to protect eggs deposited on the stream bed by mountain whitefish during December 2001 through January 2002 and (5) improving the U.S. capability to meet flow objectives for salmon at Vernita Bar below Priest Rapids Dam. This agreement supplements the 2001–2002 DOP.

- Agreement among the *Columbia River Treaty* Operating Committee and the Bonneville Power Administration and British Columbia Hydro and Power Authority on the Operation of Canadian Treaty and Libby Storage Reservoirs and Exchanges of Power for the Period 8 August 2002 through 28 February 2003, signed 30 August 2002.

This agreement provides for the optimal balancing of the storage of water in Libby and Canadian Treaty reservoirs and the storage and return of power benefits between the parties, considering mutually beneficial power and non-power objectives as outlined in the agreement.

- Addendum to *Columbia River Treaty* Operating Committee Agreement on Operation of Summer Treaty Storage for 1 August 2001 through 31 March 2002, signed 17 October 2001. The original agreement was signed 18 July 2001 and reported in the 2001 Annual Report.

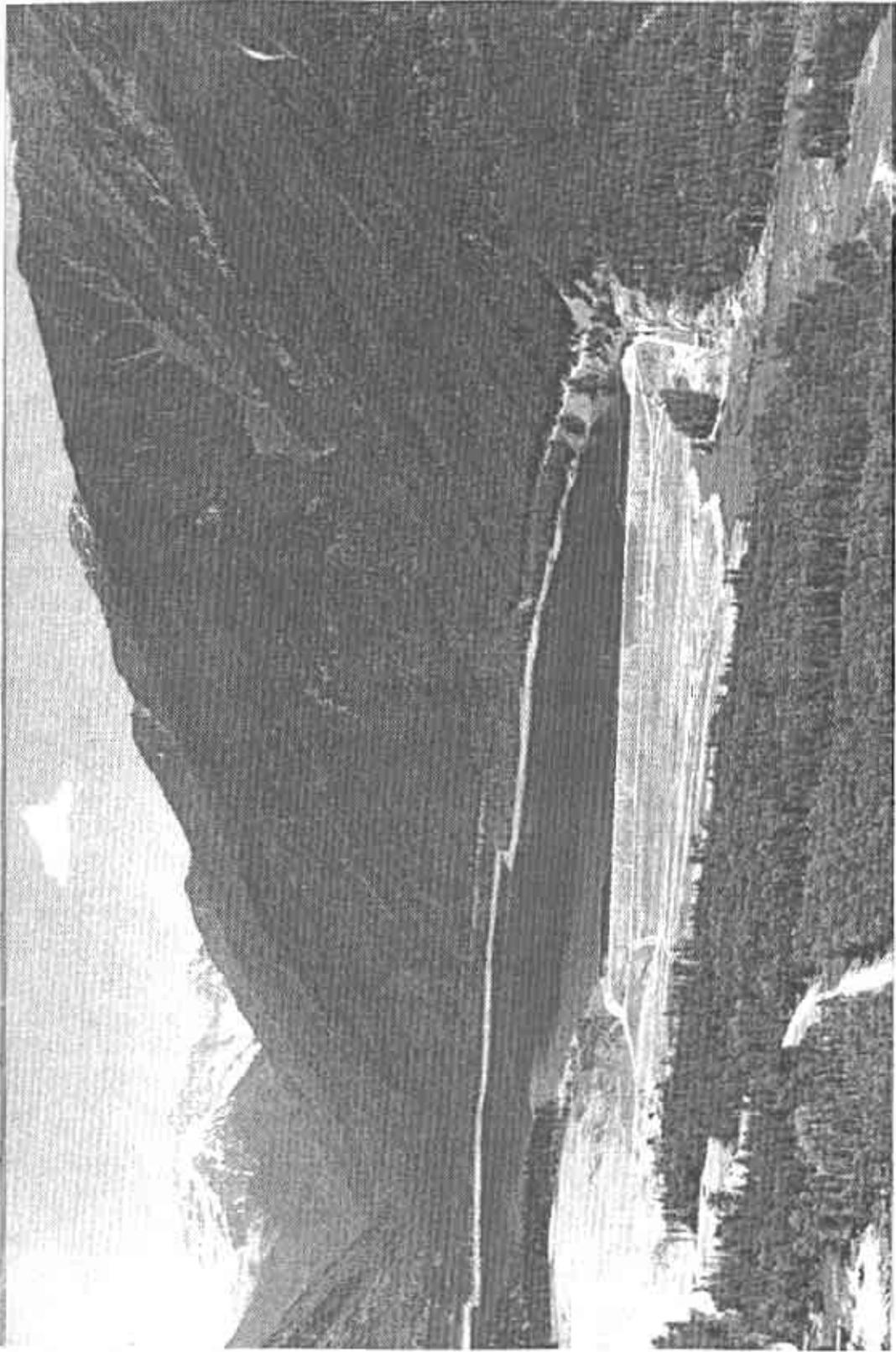
This addendum to the Agreement amends paragraph 2.b of the original agreement to allow the provisional storage of water by the U.S. Section in the Summer Treaty Storage (STS) Account with Treaty storage space from 1 August until the date of the first U.S. Section request for release of STS water or in an STS Addendum Account (STSAA) between 24:00 Pacific standard time (PST) on 14 October 2001 through 24:00 PST on 30 November 2001, subject to minimum outflow requirements for the Treaty reservoirs as specified by the Canadian Section. Paragraph 2.d was added to the original agreement in the event that the U.S. Section elects to utilize provisional storage under the STSAA. Paragraph 3.f was added to the original agreement to schedule releases of all storage in the STSAA not converted to flow augmentation by the U.S. Section during the period 24:00 PST on 31 January 2002 through 24:00 PST on 31 March 2002, to ensure a zero balance in the STSAA at 24:00 PST 31 March 2002.

- *Columbia River Treaty* Entity Agreement on the Detailed Operating Plan for Columbia River Storage for 1 August 2002 through 31 July 2003, signed 22 July 2002.
This agreement between the Entities implements the DOP for Columbia River storage during 1 August 2002 through 31 July 2003.
- Detailed Operating Plan for Columbia River Storage for 1 August 2002 through 31 July 2003, dated July 2002.
This document provides the general guidelines, operating criteria and reservoir rule curves for the operation of the three Treaty reservoirs (Mica, Arrow and Duncan) in Canada for the operating year August 2002 through July 2003.
- Annual Report of the *Columbia River Treaty*, Canadian and United States Entities, for the period 1 October 2001 through 30 September 2002, dated October 2002.
This report summarizes the operation of Treaty projects and other activities of the Entities for 1 October 2001 through 30 September 2002. Further details on the Entity Annual Report are provided later in this report.

The Board received no documents involving the operation of Columbia River non-Treaty storage during this operating year.

Report to the Governments

The thirty-seventh Annual Report of the Board was submitted to the governments of Canada and the United States on 28 February 2002.



Duncan Dam - Duncan River, British Columbia
The earth dam with discharge tunnels (*left*) and spillway (*right*)

TREATY IMPLEMENTATION

General

The implementation of the Treaty resulted in construction of the Treaty projects, development of the hydrometeorological network, annual preparation of power and flood control operating plans, and annual calculation of downstream power benefits. The three Treaty storage projects in British Columbia – the Duncan, Arrow and Mica projects – produce power and flood control benefits in Canada and the United States. The Libby storage project also provides power and flood control benefits in both countries. In the United States, increased flow regulation provided by Treaty projects facilitated the installation of additional generating capacity at existing plants on the Columbia River. In Canada, completion of the Canal Plant on the Kootenay River in 1976, installation of generators at Mica Dam in 1976–1977 and completion of the Revelstoke project in 1984, all owned by British Columbia Hydro and Power Authority, have resulted in additional power benefits. This amounts to some 4000 megawatts (MW) of generation capacity in British Columbia that may not have been installed without the Treaty. In addition, the construction of a two-unit 185-MW hydropower plant adjacent to the Hugh Keenleyside Dam was completed in 2002. Additional generating units at Revelstoke and Mica dams in Canada are also being considered.

The Treaty provides Canada with the option, which commenced in 1984, of diverting the Kootenay River at Canal Flats into the headwaters of the Columbia River. The British Columbia Hydro and Power Authority undertook engineering feasibility and environmental studies of the potential diversion. No further activities have occurred since that time.

The locations of the above projects are shown in Appendix D, Plate No. 1.

Status of the Treaty Projects

Duncan Project

Duncan Dam, the smallest Treaty project, was scheduled in the 30-year Sales Agreement for operation by 1 April 1968. It was the first of the Treaty projects to be completed. It became fully operational on 31 July 1967, well in advance of Treaty requirements. The Sales Agreement for Duncan expired March 31, 1998.

The earthfill dam is about 39.6 metres (m) (130 feet) high and extends 792.5 m (2600 feet) across the Duncan River valley, approximately 9.7 kilometres (km) (six miles) north of Kootenay Lake. The reservoir behind the dam extends for about 43.5 km (27 miles) and provides 1.73 km³ (1.4 million acre-feet) of usable storage, which is committed under the Treaty. No power facilities are included in this project.

The project is shown on page 13, and project data are provided in Appendix D, Table 1.

Arrow Project

The Hugh Keenleyside Dam, at the outlet of the Arrow Lake, was the second Treaty project to be completed. It became operational on 10 October 1968, well ahead of the date of 1 April 1969 scheduled by the 30-year Sales Agreement. The Sales Agreement for Arrow expired March 31, 1999.

The dam consists of two main components: a concrete gravity structure that extends 366 m (1200 feet) from the north bank of the river and includes the spillway, low-level outlets and navigation lock; and an earthfill section that rises 52 m (170 feet) above the riverbed and extends 503 m (1650 feet) from the navigation lock to the south bank of the river. The reservoir, about 233 km (145 miles) long, includes the Upper and Lower Arrow lakes and provides 8.8 km³ (7.1 million acre-feet) of Treaty storage.

The new 185-MW power plant at the Arrow Project, owned by Arrow Lakes Power Development Corporation, is located on the north abutment (left bank). An intake approach channel, about 1493 m (4900 feet) long around the north end of the concrete dam, diverts waters of the Arrow reservoir through a powerhouse located in a rock outcrop 396 m (1300 feet) downstream. The generating facility contains two 92.5-MW Kaplan turbines. The facility is connected by a new 230-kV transmission line to the Selkirk substation, for integration into the British Columbia Hydro and Power Authority's existing power grid. The installation of the generating units was completed in the spring of 2002, and the power production at the new generating facilities is incidental to releases made for Treaty purposes. This new power plant will reduce spill at Keenleyside Dam and will provide environmental benefits by reducing entrained gases that are harmful to fish.

The project is shown on page 7, and project data are provided in Appendix D, Table 2.

Mica Project

Mica Dam, the largest of the Treaty projects, was scheduled by the 30-year Sales Agreement for initial operation on 1 April 1973. The project was declared operational and commenced storing on 29 March 1973. The Sales Agreement for Mica will expire March 31, 2003.

Mica Dam is located on the Columbia River about 137 km (85 miles) north of Revelstoke, British Columbia. The earthfill dam rises more than 244 m (800 feet) above its foundation and extends 793 m (2600 feet) across the Columbia River valley. It creates a reservoir 217 km (135 miles) long, Kinbasket Lake, with a total storage capacity of 24.7 km³ (20 million acre-feet). The project utilizes 14.8 km³ (12 million acre-feet) of live storage, of which 8.6 km³ (7 million acre-feet) are committed under the Treaty.

Although not required by the Treaty, the British Columbia Hydro and Power Authority added a powerhouse to the project. The underground powerhouse has space for six generators. Four generators have been installed and currently produce a maximum capacity of 1805 MW.

The project is shown on page 21, and project data are provided in Appendix D, Table 3.

Libby Project in the United States

Libby Dam is located on the Kootenai River, 27.4 km (17 miles) northeast of the town of Libby, Montana. Construction began in the spring of 1966; storage has been fully operational since 17 April 1973. Commercial generation of power began on 24 August 1975, which coincided with the formal dedication of the project. The concrete gravity dam is 931 m (3055 feet) long, rises 113 m (370 feet) above the riverbed and creates Lake Koocanusa, which is 145 km (90 miles) long and extends 67.6 km (42 miles) into Canada. Lake Koocanusa has a gross storage of 7.2 km³ (5 869 000 acre-feet), of which 6.1 km³ (4 980 000 acre-feet) are usable for flood control and power purposes. The Libby powerhouse, when completed in 1976, had four units with a total installed capacity of 420 MW.

Construction of four additional generating units was initiated during fiscal year 1978, but Congressional restrictions imposed in the 1982 *Appropriations Act* provided for completion of only one of these units. That unit became available for service late in 1987. The total installed capacity for the five units is 525 MW. Recent U.S. legislation (Public Law 104-303, 12 October 1996) authorizes the Corps of Engineers to complete generating units 6 through 8. No action to do so has been taken during this report period.

The Libby project is shown on page 2, and project data are provided in Appendix D, Table 4.

Libby Project in Canada

Canada has fulfilled its obligation to prepare the land required for the 67.6-km (42-mile) portion of Lake Koocanusa in Canada. The British Columbia Hydro and Power Authority is now responsible for reservoir debris clean up.

Hydrometeorological Network

One of the responsibilities assigned to the Entities by the Treaty is the establishment and operation, in consultation with the Permanent Engineering Board, of a hydrometeorological system to obtain data for detailed programming of flood control and power operation. This system includes snow courses, meteorological stations and stream-flow gauges. The *Columbia River Treaty* Hydrometeorological Committee, formed by the Entities, makes recommendations on further development of the Treaty Hydrometeorological System.

In developing the hydrometeorological network, the Entities, with the concurrence of the Board, adopted a document in 1976 that defined the *Columbia River Treaty* Hydrometeorological System. The document also outlined a method of classifying facilities into those required as part of the Treaty System and those of value as Supporting Facilities. During the 1976-1977 report year, the Entities, with the concurrence of the Board, adopted a plan for the exchange of operational hydrometeorological data.

During recent years, as a result of the emergence and adoption of more sophisticated stream-flow forecasting procedures, the number of stations used in the Treaty studies have increased from 866 in 1992 to about 1500 in 2000. Considerable effort was required to classify and prepare documentation of network stations on a regular basis.

The Entities briefed the Board in February 2001 on the re-definition of hydrometeorological facilities required as part of the Treaty System and those with value as Supporting Facilities. The Entities provided a letter dated June 20, 2001, to the Board, describing their proposal for future updates of the document. The Board studied the proposal and concluded that it provides an appropriate mix of data, forecasting and modelling methodologies to effectively implement the requirements of the Treaty. The change took effect October 1, 2001.

The Entities eliminated the practice of categorizing each data station as either "Treaty" or "Support." Instead, a new classification called "Treaty/Support" was adopted for stations that are used directly or indirectly to monitor, plan and operate Treaty projects. The Entities will communicate with data collection agencies on a regular basis to remain informed of the status of the network. They will also take steps necessary to ensure that the monitoring, planning and operation of Treaty facilities are not adversely affected by any changes to the hydrometeorological network. The format of future Hydrometeorological Committee documents will be revised to include only changes to the network as opposed to complete listings of all stations.

Power Operating Plans and Calculation of Downstream Power Benefits

The Treaty and related documents require the Entities to agree annually on operating plans and on the resulting downstream power benefits for the sixth succeeding year of operation. These operating plans, prepared five years in advance, are called assured operating plans (AOPs). They represent the basic commitment of the Canadian Entity to operate the Treaty storage in Canada (Duncan, Arrow and Mica) and provide the Entities with a basis for system planning. Canada's commitment to operate under an AOP is tied directly to the benefits produced by that plan. At the beginning of each operating year, a detailed operating plan (DOP), which includes the three Treaty storage projects in Canada and the Treaty project in the United States (Libby), is prepared on the basis of current resources and loads to obtain results that may be more advantageous to both countries than those that would be obtained by operating in accordance with the AOP.

The AOP for the 2001–2002 operating year provides criteria for Treaty operations. The Determination of Downstream Power Benefits (DDPB), which was also prepared in advance along with the AOP, defines the power benefits under the Treaty, based on the same Treaty operation criteria contained in the AOP. During the report year, actual operations of the Treaty storage in Canada were regulated under the rule curves set out in

the Entities' report entitled *Detailed Operating Plan (DOP) for Columbia River Treaty Storage, 1 August 2001 through 31 July 2002*, agreed to in July 2001, and in accordance with additional Entities' agreements signed during the year. The DOP for Canadian storage was based on the operating criteria and hydroregulation studies contained in the 2001–2002 AOP together with any changes thereto agreed to by the Entities. Beginning with the 2000–2001 DOP, Libby operating criteria and the expected operation of the Libby project are no longer included in the DOP. Information for Libby operation was presented separately in the Libby Operating Plan prepared by the U.S. Entity. The actual Pacific Northwest Coordination Agreement (PNCA) operations in the U.S. system are based on the U.S. Fish and Wildlife Service and the National Marine Fishery Service Biological Opinions and associated non-power requirements. One of the main measures defined in the Biological Opinions includes changing the customary seasonal release rates from Libby Dam such that spring and summer flows would be higher, and fall and winter flows lower, than in the past.

The Canadian Entity believes that these fishery operations are not consistent with the Treaty. However, as reported in the 2000 Board Annual Report, the Libby Coordination Agreement (LCA) signed on 16 February 2000 addressed the issues concerning the operations of the Libby Project. It also allowed the Entities to coordinate reservoir operations and agree to AOPs and DDPBs without the need for them to alter their respective positions regarding the validity of the Libby fisheries operation under the Treaty. The LCA essentially freezes the dispute, potentially until 2024, unless either Entity chooses to terminate early, on 30 days' notice. Details of the LCA are presented in the "Operation" section of this report. The Entities successfully implemented the LCA during the two years of operation.

It was reported in the 1996, 1997 and 1998 Board Annual Reports that the *Entity Agreement on Resolving the Dispute on Critical Period Determination, the Capacity Entitlement for the 1998–1999, 1999–2000 and 2000–2001 AOP/DDPBs, and Operating Procedures for the 2001–2002 and Future AOPs* resolved a lengthy dispute regarding the calculation of the downstream power benefits. If this issue is raised in the future, the Board will re-examine the matter by using its earlier recommendations as guidelines on the appropriate Treaty interpretation and application of the critical stream-flow period definition and the established operating procedures. A more detailed discussion of this issue is contained in the 1996 and 1997 annual reports of the Board.

The arrangements for returning the Canadian Entitlement to British Columbia across existing transmission lines are based on the agreement entitled *Columbia River Treaty Entity Agreement on Aspects of the Delivery of the Canadian Entitlement for April 1, 1998, through September 15, 2024*, which was signed 29 March 1999. This agreement provides arrangements for the delivery of the Canadian Entitlement, including the point of delivery, method of accounting for transmission losses and guidelines for scheduling.

In addition to the delivery agreement referred to above, the terms and conditions for the disposal of portions of the Canadian Entitlement within the United States are based on the agreement entitled *Agreement on Disposals of the Canadian Entitlement Within the United States for April 1, 1998, through September 15, 2024, Between Bonneville Power Administration, Acting on Behalf of the U.S. Entity and the Province of British Columbia*, signed 29 March 1999.

Both the delivery agreement and the disposal agreement became effective on 31 March 1999 through a diplomatic exchange of notes between the United States and Canada.

Transmission Developments

The Bonneville Power Administration continues to work on potential new transmission configurations. It has adopted operational practices that place Entitlement return on an equal footing with other firm Pacific Northwest customers during curtailment periods.

As part of the continuing effort to provide open access for wholesale power transactions in the United States, the Federal Energy Regulatory Commission (FERC) issued Order 2000 calling for the creation of independent regional transmission organizations (RTOs). FERC subsequently issued additional guidance for a "one-size-fits-all" standard market design (SMD) to further encourage development of wholesale electricity markets.

In the Pacific Northwest, RTO-West is being developed to address the complexities of the western system. Concerns have subsequently been expressed that the SMD concept may not be compatible with large hydropower systems like those in the Pacific Northwest. In response to concerns over the application of an SMD in the Western interconnection, FERC established public working-group meetings to address specific issues related to market design in the Western interconnection. Final comments on the Notice of Proposed Rulemaking are due in February 2003. FERC's final SMD Rule is expected to be issued in the second half of 2003.

The impact of RTOs and an SMD on implementation of the Treaty is unclear at this time. As the concepts of RTOs and SMD evolve, the Board will continue to keep the governments informed, particularly concerning any implications on Treaty implementation.

Flood Control Operating Plans

The Treaty provides that Canadian storage reservoirs will be operated by the Canadian Entity in accordance with operating plans designed to minimize flood damage in the United States and Canada. The *Columbia River Treaty Flood Control Operating Plan*, dated October 1972, and the revised plan, dated October 1999, defined the flood control operation of the Duncan, Arrow, Mica and Libby reservoirs during the period covered in this report. The 1972 plan was received from the Entities and reviewed by the Board in the 1972-1973 report year; it was in effect until October 1999. This 1972 plan has been replaced by the new plan completed in October 1999.

Flow Records

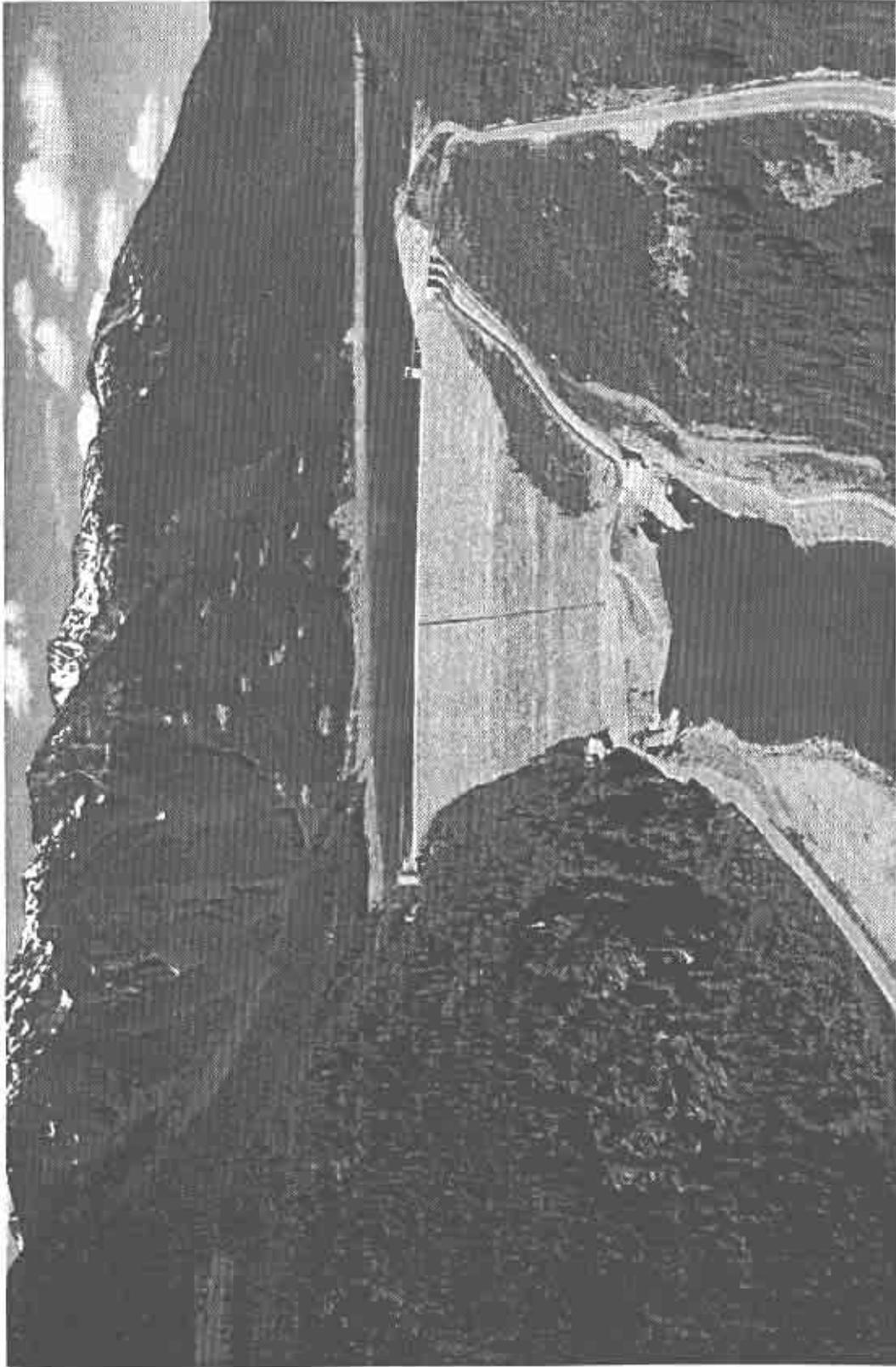
Article XV (2)(a) of the Treaty specifies that the Permanent Engineering Board shall assemble records of flows of the Columbia and Kootenai rivers at the Canada–United States boundary. Flows for this report year are tabulated in Appendix C for the Kootenai River at Porthill, Idaho, and for the Columbia River at Birchbank, British Columbia.

Non-Treaty Storage

Since 1984, agreements have also been reached between the British Columbia Hydro and Power Authority and the Bonneville Power Administration concerning the use of non-Treaty storage. These agreements do not interfere with operations under the Treaty. They do extend the concepts of the Treaty and benefit the British Columbia Hydro and Power Authority and the Bonneville Power Administration.

Operations for Fish

Many U.S. reservoirs are presently operated in accordance with Biological Opinions issued by the U.S. Fish and Wildlife and the National Marine Fisheries Service under the *Endangered Species Act*. Treaty reservoirs in Canada are operated in accordance with the requirements of Fisheries and Oceans Canada. These efforts continue to evolve. In this regard, the Board notes that the AOPs and the DDPBs are to be based on optimal operation for power and flood control in accordance with the requirements of the Treaty. The Board continues to maintain its long-standing position that the Entities may develop DOPs to address fishery needs providing those actions do not conflict with Treaty requirements.



Mica Dam and Lake Kinbasket – Columbia River, British Columbia
The earth dam showing the spillway (*right*), with the underground powerhouse (*left*)

OPERATION

General

The *Columbia River Treaty* Operating Committee was established by the Entities to develop operating plans for the Treaty storage and to direct operation of this storage in accordance with the terms of the Treaty and subsequent Entity agreements.

During the report year, the Treaty storage in Canada was operated by the Canadian Entity in accordance with the following documents:

- *Columbia River Treaty* Entity Agreement on Principles for Preparation of the Assured Operating Plan and Determination of Downstream Power Benefits, dated July 1988.

This agreement states principles for changes in the preparation of the Assured Operating Plans (AOPs) and Determination of Downstream Power Benefits (DDPBs). These changes involve revisions of information to be used in such studies as the definition of the power loads and generating resources in the Pacific Northwest area, the stream flows to be used, the estimates of irrigation withdrawals and return flows, and other related information.

- *Columbia River Treaty* Entity Agreement on Changes to Procedures for the Preparation of the Assured Operating Plan and Determination of Downstream Power Benefit Studies, dated August 1988.

This agreement states the specific procedures to be used in implementing the previous agreement on Principles for Preparation of the Assured Operating Plan and Determination of Downstream Power Benefits.

- Agreement executed by the United States of America Department of Energy acting by and through the Bonneville Power Administration and British Columbia Hydro and Power Authority relating to: (a) Use of Columbia River non-Treaty Storage, (b) Mica and Arrow Refill Enhancements and (c) Initial Filling of non-Treaty Reservoirs, signed 9 July 1990.

This agreement provides information relating to the initial filling of Revelstoke Reservoir, the coordinated use of some of the Columbia River non-Treaty storage and the actions taken to enhance the refill of the reservoirs impounded by Mica and Arrow dams.

- *Columbia River Treaty* Principles and Procedures for Preparation and Use of Hydroelectric Operating Plans, dated December 1991.

This document serves as a guide for the preparation and use of hydroelectric operating plans, such as the AOPs and Detailed Operating Plans (DOPs) used to plan the operation of Columbia River Treaty storage.

- Assured Operating Plan for *Columbia River Treaty Storage*, 1 August 2001 through 31 July 2002, dated January 2000.

This document provides information on the operation plan for Columbia River Treaty storage and resulting downstream power benefits for 1 August 2001 through 31 July 2002.

- *Columbia River Treaty Entity Agreement on Aspects of the Delivery of the Canadian Entitlement for April 1, 1998, through September 15, 2024*, signed 29 March 1999.

This agreement provides arrangements for the delivery of the Canadian Entitlement, including the point of delivery, method of accounting for transmission losses and guidelines for scheduling. The agreement became effective on 31 March 1999 through a diplomatic exchange of notes between the United States and Canada. Execution of this agreement supersedes and terminates the Columbia River Treaty Entity Agreement on Aspects of the Delivery of the Canadian Entitlement for April 1, 1998, through September 15, 2024, between the Canadian Entity and the United States Entity, dated 20 November 1996, and the Entity Agreement of the same name, dated 26 March 1998, but which never reached its effective date.

- *Agreement on Disposals of the Canadian Entitlement Within the United States for April 1, 1998, through September 15, 2024*, Between the Bonneville Power Administration, Acting on Behalf of the U.S. Entity, and the Province of British Columbia, signed 29 March 1999.

This agreement describes the arrangements by which the Canadian Entitlement shall be disposed of in the United States by British Columbia.

- *Columbia River Treaty Flood Control Operating Plan*, dated October 1999.

This plan prescribes the criteria and procedures by which the Canadian Entity will operate Mica, Duncan and Arrow Reservoirs to achieve desired flood control objectives in the United States and Canada. Criteria for Libby Reservoir were included in the plan to meet the Treaty requirement to coordinate its operation for flood control protection in Canada. The plan was originally prepared in October 1972. This 1999 plan updates information, incorporates new storage-reservation diagrams and clarifies procedures.

- *Columbia River Treaty* Entity Agreement Relating to Extension of the Expiration Date of the Non-Treaty Storage Agreement, signed 28 June 2002.
This agreement between the Entities extends the use of Columbia River non-Treaty storage, Mica and Arrow Refill Enhancements and the initial filling of non-Treaty storage to 24:00 on 30 June 2004.
- *Columbia River Treaty* Entity Agreement on the Detailed Operating Plan for Columbia River Storage for 1 August 2002 through 31 July 2003, signed 22 July 2002.
This agreement between the Entities implements the DOP for Columbia River storage during 1 August 2002 through 31 July 2003.
- Detailed Operating Plan for Columbia River Storage for 1 August 2002 through 31 July 2003, dated July 2002.
This document provides the general guidelines, operating criteria and reservoir rule curves for the operation of the three Treaty reservoirs (Mica, Arrow and Duncan) in Canada for the operating year from August 2002 through July 2003.
- *Columbia River Treaty* Operating Committee Agreement on Operation of Treaty Storage for Non-Power Uses for 1 January 2002 through 31 July 2002, signed 7 February 2002.
This agreement is similar to previous agreements implemented to utilize Treaty storage for non-power uses. These uses include (1) providing flows for Canadian trout spawning for April through June, (2) enhancing the capability in the United States of providing spring and summer flow augmentation for salmon and steelhead by storing 1 million acre-feet of water in Arrow by late April, (3) enhancing Arrow lake levels by ensuring progressive refill, (4) providing a minimum discharge objective at Arrow during February and March 2002 to protect eggs deposited on the stream bed by mountain whitefish during December 2001 through January 2002 and (5) improving the U.S. capability to meet flow objectives for salmon at Vernita Bar below Priest Rapids Dam. This agreement supplements the 2001–2002 Detailed Operating Plan.
- Agreement among the *Columbia River Treaty* Operating Committee and the Bonneville Power Administration and British Columbia Hydro and Power Authority on the Operation of Canadian Treaty and Libby Storage Reservoirs and Exchanges of Power for the Period 8 August 2002 through 28 February 2003, signed 30 August 2002.

This agreement provides for the optimal balancing of the storage of water in Libby and Canadian Treaty reservoirs and the storage and return of power benefits between the parties, considering mutually beneficial power and non-power objectives as outlined in the agreement.

- Addendum to *Columbia River Treaty* Operating Committee Agreement on Operation of Summer Treaty Storage for 1 August 2001 through 31 March 2002, signed 10 October 2001. The original agreement was signed 18 July 2001 and reported in the last Annual Report.

This addendum to the agreement amends Paragraph 2.b of the original agreement to allow the provisional storage of water by the U.S. Section in the Summer Treaty Storage (STS) Account with Treaty storage space from 1 August until the date of the first U.S. Section request for release of STS water or in an STS Addendum Account (STSAA) between 24:00 PST on 14 October 2001 through 24:00 PST on 30 November 2001, subject to minimum outflow requirement for Treaty reservoirs as specified by the Canadian Section. Paragraph 2.d was added to the original agreement in the event that the U.S. Section elects to utilize provisional storage under the STSAA. Paragraph 3.f was added to the original agreement to schedule releases of all storage in the STSAA by the U.S. Section not converted to flow augmentation during the period 24:00 PST on 31 January 2002 through 24:00 PST on 31 March 2002 to ensure a zero balance in the STSAA at 24:00 PST on 31 March 2002.

- Annual Report of the *Columbia River Treaty* Canadian and United States Entities, for the period 1 October 2001 through 30 September 2002, dated November 2002.

This report summarizes the operation of Treaty projects and other activities of the Entities for 1 October 2001 through 30 September 2002. Further details on the Entities' annual report are provided later in this report.

Power Operation

The 2001–2002 operating year followed the second lowest January-through-July runoff at The Dalles since 1928. As a result, reservoirs were low and the region was anticipating what the new year would bring. Fortunately, precipitation across the basin began to return to normal by fall 2001. By 1 January 2002, the water supply forecast for the Columbia River at The Dalles (January–July) was 121.8 cubic kilometres (km³) (98.7 million acre-feet) (Maf), or 93 percent of the 1971–2000 average. With near normal precipitation continuing through the winter and spring, monthly runoff forecasts for January through July remained near average for the entire forecast period. The observed runoff at The

Dalles for January through July 2002 was 128.0 km³ (103.8 Maf), or 98 percent of average. With this slightly below average runoff, much of the storage drafted during the extremely dry 2001 “water year” was recovered. While the Canadian Treaty storage drafted to 1.2 km³ (0.9 Maf) on 31 March 2002, it refilled to 17.5 km³ (14.2 Maf), or 91.3 percent full, on 31 July 2002. All U.S. projects filled to within 0.15 metres (0.5 feet) from full in 2002.

At the beginning of the 2001–2002 operating year, the Treaty Storage Regulation (TSR) level for Canadian storage was only 49.9 percent full, and the Coordinated System storage level was 67.1 percent full. Actual Canadian storage levels on 31 July 2001 were 65.7 percent full due to a supplemental operating agreement for summer storage. Due to the record low unregulated stream flows during the prior operating year, the hydro system continued to draft proportionally well below the Operating Rule Curve (ORC) through April in order to create the firm load carrying capability determined in the critical period studies. During May through July, most of the coordinated system recovered to the ORC, with the main exception of Mica, which was limited by minimum flow requirements. Actual Canadian Treaty storage on 31 July 2002 reached 91.3 percent full, and the TSR storage level for Canadian storage was 91.8 percent full.

The Canadian Treaty projects – Duncan, Mica and Arrow – were operated throughout the year in accordance with the 2001–2002 Detailed Operating Plan, the October 1999 Flood Control Operating Plan and several supplemental operating agreements noted in the previous “General” section of this report (pages 22–25). Throughout the year, Libby Dam in the United States was operated according to the 1999 Flood Control Operating Plan and the Libby Coordination Agreement (LCA) dated February 2000. In accordance with the LCA, the U.S. Army Corps of Engineers updated the Libby Operating Plan in 2002. Libby was also operated according to guidelines set forth in the U.S. Fish and Wildlife Service and the U.S. National Marine Fisheries Service (NOAA Fisheries) 2000 Biological Opinions (BiOps).

The Columbia River in the United States was operated for flood control and in accordance with the 2000 BiOps. Storage project releases were made to maintain a minimum flow at Bonneville Dam downstream of the project from November through April for the benefit of the listed endangered chum salmon. Storage projects were also drafted January through April for flood control. Since the water supply forecast had returned to near average, normal operations under the NOAA Fisheries 2000 BiOp resumed. In accordance with the BiOp, spill was provided for spring and summer juvenile fish passage at all lower Columbia River projects, except Lower Monumental Dam. The Lower Snake River projects were operated at or near their minimum operating pools for the season to enhance juvenile fish migration. Storage projects were operated to reach their 10 April flood-control elevations and end of June refill targets to help meet flow objectives at McNary and Lower Granite dams.

Mica Project

Mica reservoir elevation reached a maximum of 742.14 metres (m) (2434.8 feet) on 3 September 2001, 13.24 m (40.2 feet) below full pool. The reservoir reached its lowest level for the year, elevation 712.40 m (2337.2 feet), on 12 April 2002. This level set a new record low for the Mica reservoir. The reservoir recovered substantially during 2002, reaching a maximum elevation of 751.36 m (2465.1 feet) on 3 September 2002, which was 3.02 m (9.9 feet) below full pool.

Arrow Project

The Arrow reservoir elevation reached a maximum of 430.42 m (1412.1 feet) on 3 July 2001. The reservoir reached its lowest level of the year at elevation 422.52 m (1386.2 feet) on 14 January 2002. During 21 December 2001 to 20 January 2002, Arrow outflows were held at 934.6 cubic metres per second (m³/s) (33 000 cubic feet per second [cfs]) to maintain low river levels during the whitefish spawning period. During April and May 2002, outflows were held between 424.8 m³/s (15 000 cfs) and 566.4 m³/s (20 000 cfs). This was to ensure successful rainbow trout spawning immediately below Arrow at water levels that could be maintained until hatch and to help meet non-power requirements in the United States. The Arrow reservoir reached its highest level on 17 August 2002 at elevation 439.92 m (1443.3 feet), 0.21 m (0.7 feet) below full pool.

The Arrow Lakes Power Company project at Keenlyside Dam began commercial operation during 2002.

Duncan Project

Duncan reservoir did not refill during 2001, reaching a maximum elevation of 571.72 m (1875.7 feet) on 4 August 2001, which was 4.97 m (16.3 feet) below full pool. From August through December, Duncan discharge was used to supplement inflow into Kootenay Lake. By 31 December 2001, the reservoir had drafted to 550.93 m (1807.5 feet), which was 4.06 m (13.3 feet) above empty pool elevation. Duncan reservoir reached empty on 13 March 2002. With above average inflow during the 2002 freshet, the reservoir refilled to a full pool elevation of 576.68 m (1892.0 feet) by 15 July 2002.

Libby Project

At the end of the previous operating year, Libby reached an elevation of 742.88 m (2436.6 feet) on 31 July 2001, which was 6.83 m (22.4 feet) from full. With the large amount of precipitation in May, the June early-bird water supply forecast showed a significant increase at Libby for April through August: it increased from 100 percent to 114 percent. As a result, Libby flows were ramped up from 227 m³/s to

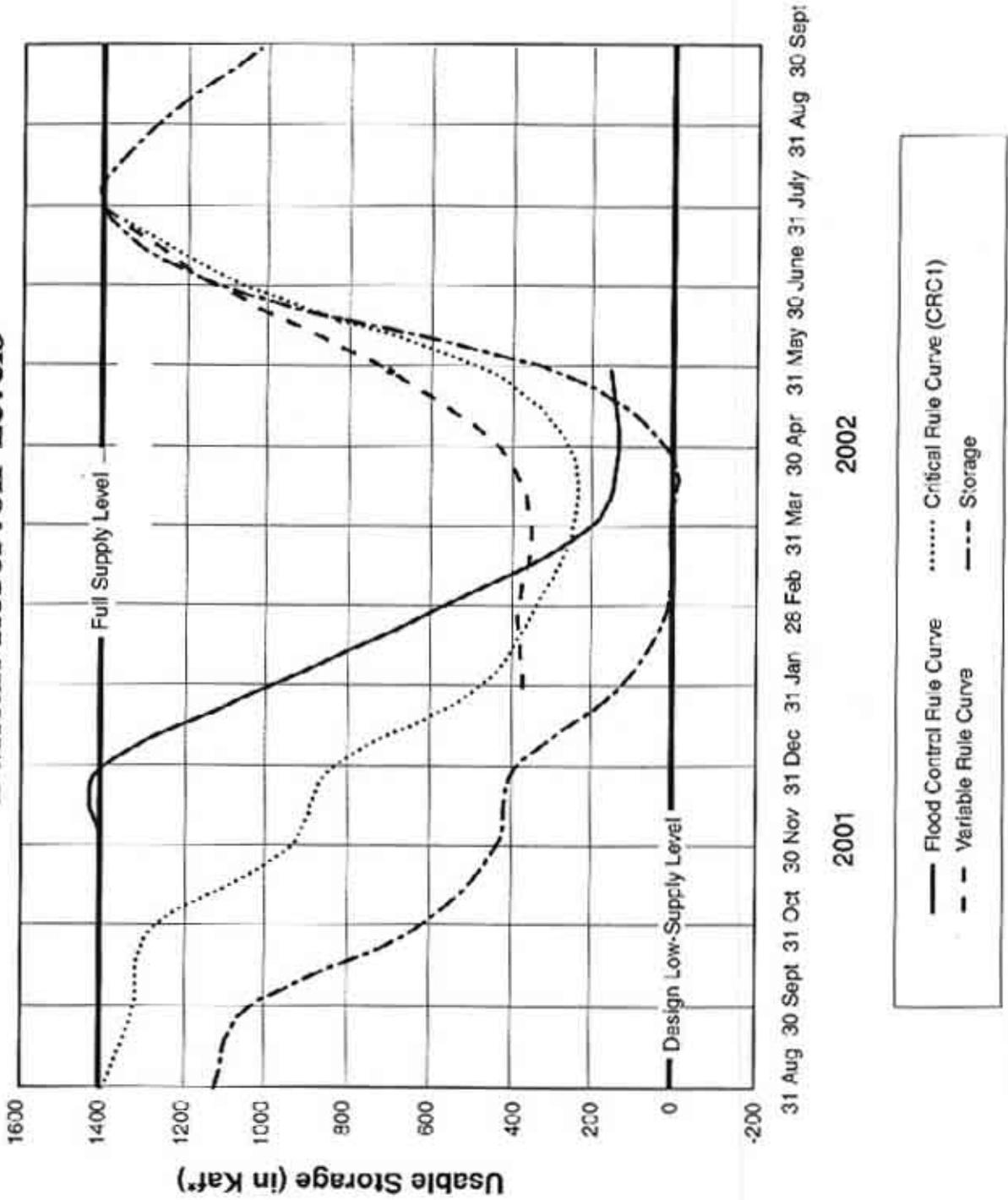
510 m³/s (8000 cfs to 18 000 cfs) by 6 June. When the final water supply forecast came out at 8.27 km³ (6.7 Maf), or 107 percent of average, the short-term models showed a need to increase the release rate further. Libby was increased up to full load, 736 m³/s (26 000 cfs), by 12 June. Temperatures increased in June and inflows rose dramatically. The U.S. Army Corps of Engineers – Seattle District was planning on conducting a spill test at Libby per the NOAA Fisheries 2000 BiOp. The spill test was noteworthy since the project had not spilled since June 1986, nor had it spilled significantly (amounts over 142 m³/s [5000 cfs]) since July 1981. Spill for the test began on 25 June and called for increasing amounts of spill over three days. The reservoir began filling quickly, and it became apparent that Libby would need to spill more water than the test required to avoid filling the project too quickly. After the completion of the spill test on 26 June 2002, spill amounts were increased and the project reached a maximum outflow of 1133 m³/s (40 000 cfs) on 2 July 2002. Libby ended June at 748.83 m (2456.8 feet), which was 0.67 m (2.2 feet) from full. Libby inflow in June was 1518 m³/s (53 600 cfs), which was 146 percent of the average. Inflows for the year peaked at 2036 m³/s (71 900 cfs) on 18 June.

Lake Koocanusa reached its peak elevation – 749.38 m (2458.6 feet) – on 15 July 2002, or 0.12 m (0.4 feet) from full. Inflows began receding and Libby stopped spilling on 17 July. For the rest of July, flows were held steady in an attempt to stabilize flows, which benefited habitat and food supply for downstream fish. The project ended July at an elevation of 748.34 m (2455.2 feet), which was 1.16 m (3.8 feet) from full. Inflows for July averaged 699 m³/s (24 700 cfs), which was 121 percent of average.

Flood Control Operation

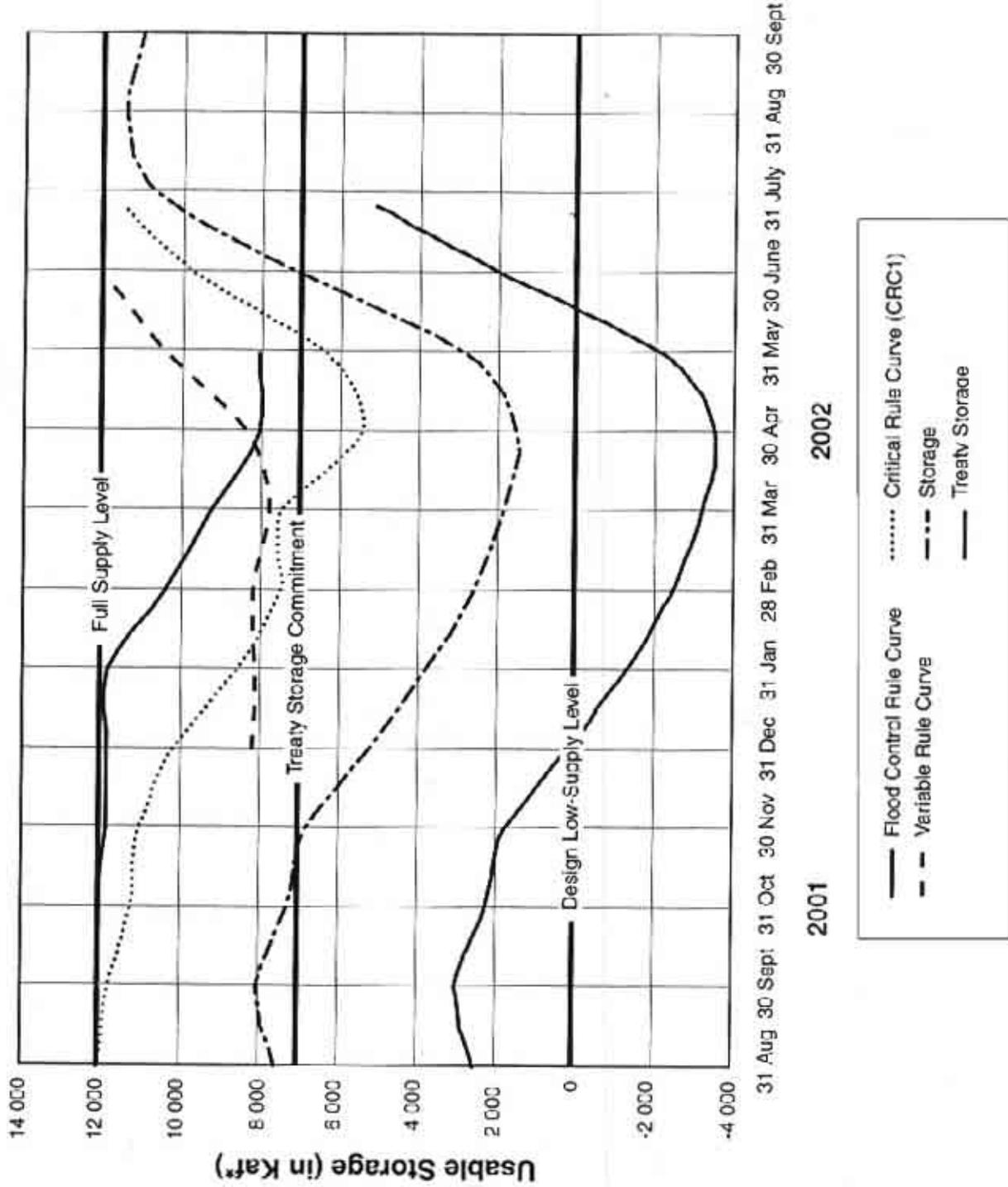
The Columbia River basin reservoir system, including the *Columbia River Treaty* projects, was drafted in the winter in preparation for the spring freshet. No major flooding occurred. The regulated peak flow at The Dalles, Oregon, was 10 600 m³/s (374 400 cfs) on 6 June 2002; the unregulated flow was estimated at 17 180 m³/s (606 800 cfs) on 7 June 2002. The peak stage observed at Vancouver, Washington, was 3.99 m (13.1 feet) on 18 April 2002. And the estimated unregulated stage was 6.34 m (20.8 feet) on 8 June 2002.

Duncan Reservoir Levels

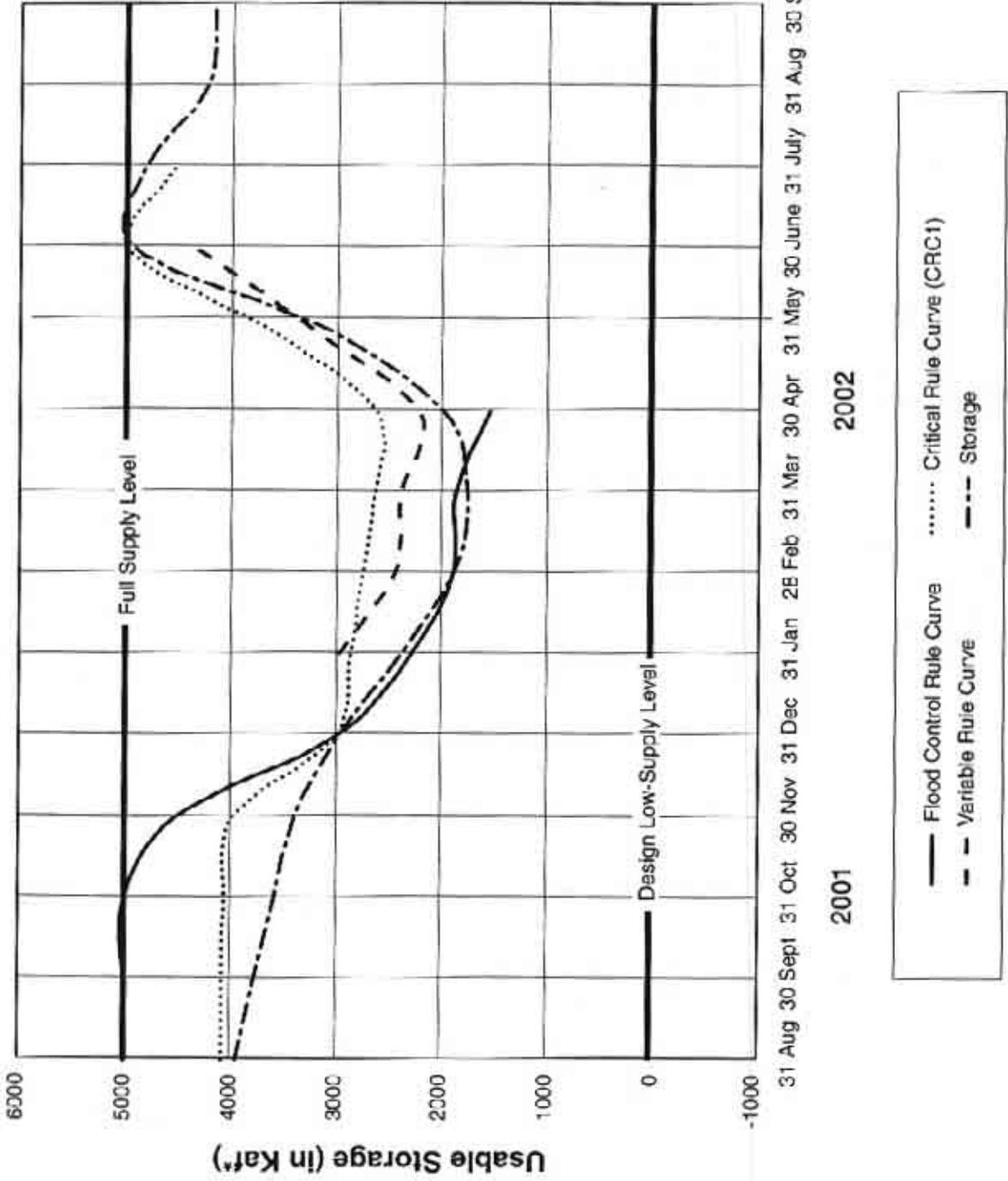


* Kaf = thousand acre-feet

Mica Reservoir Levels

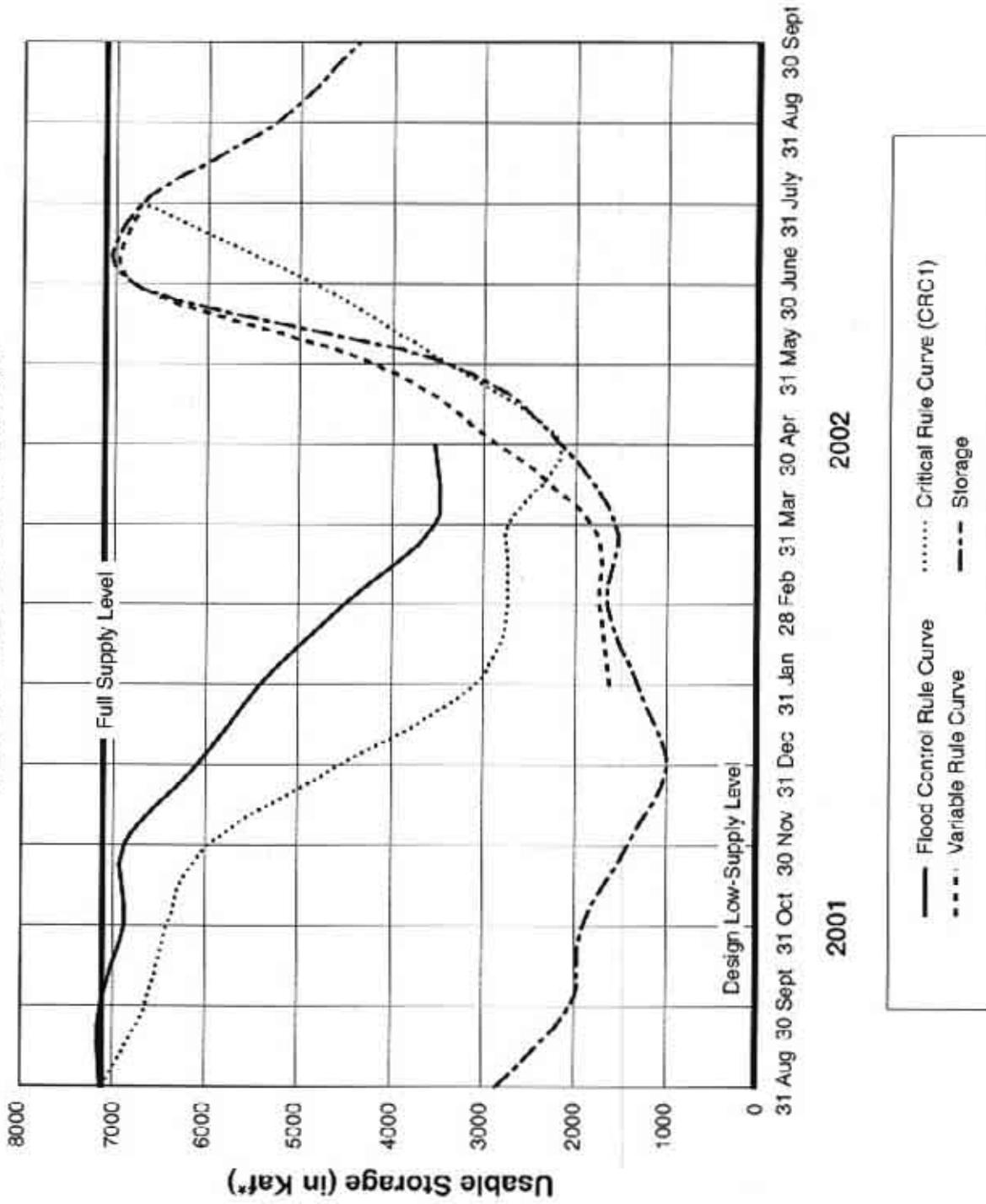


Libby Reservoir Levels

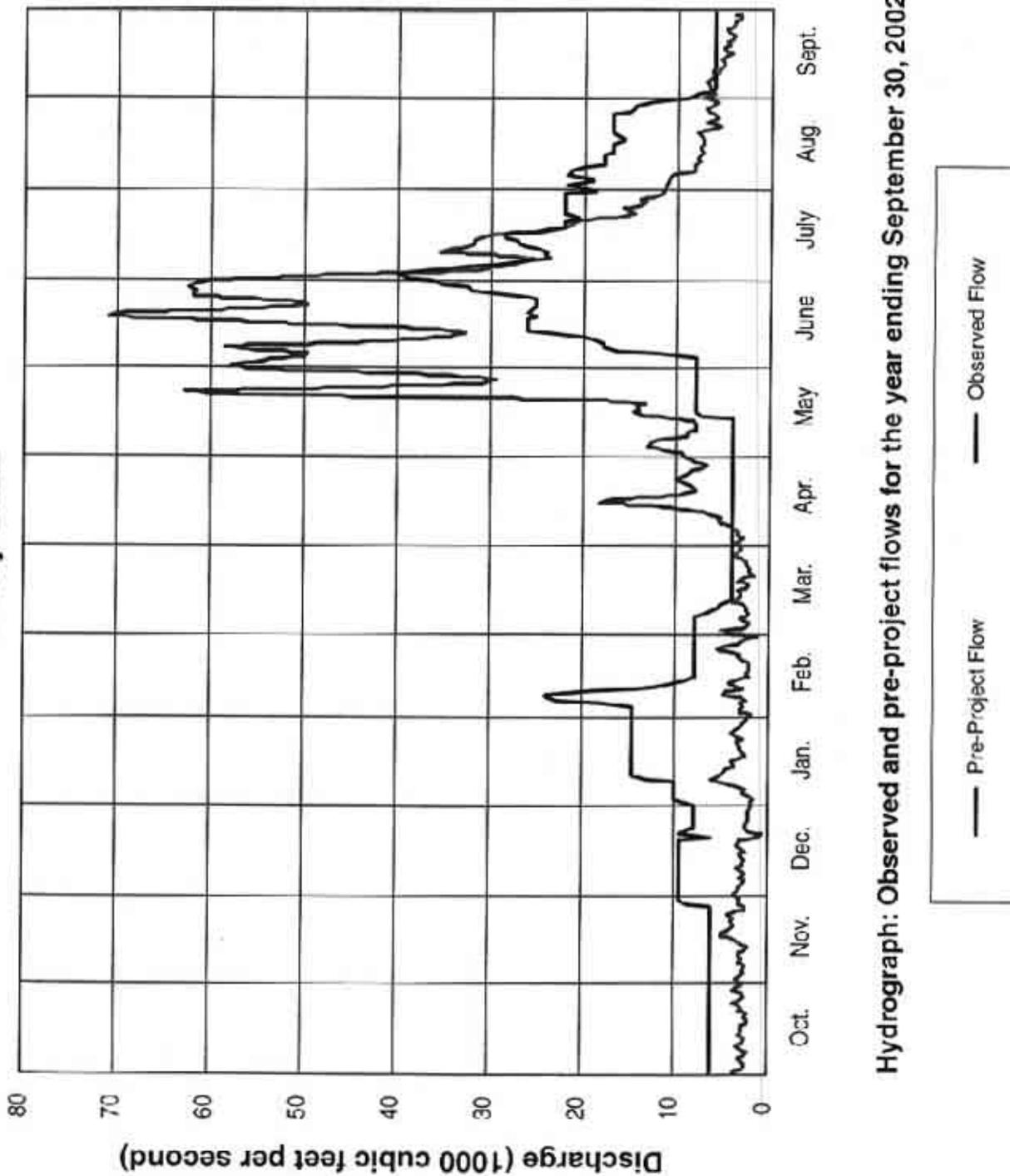


* Kaf = thousand acre-feet

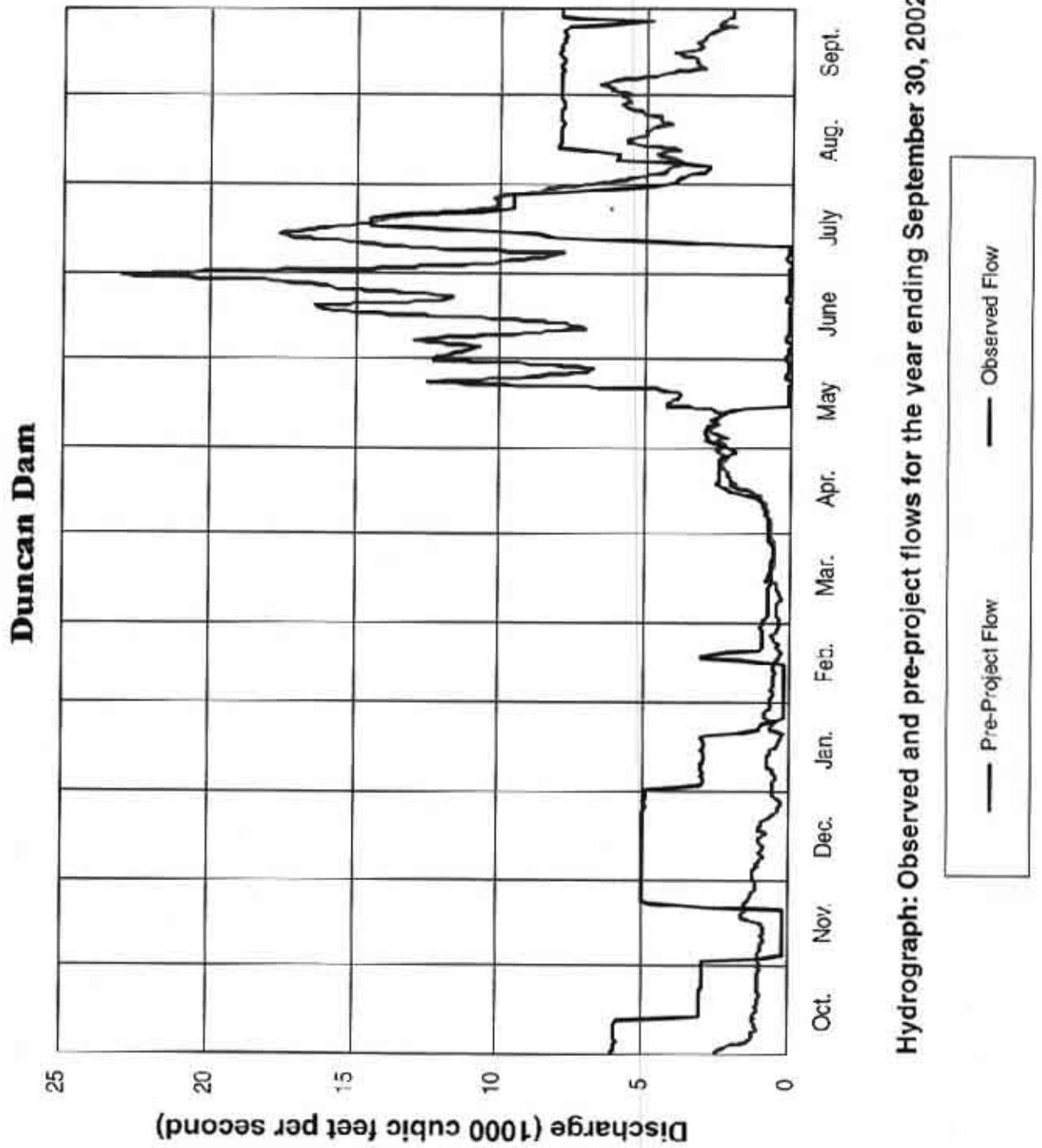
Arrow Reservoir Levels



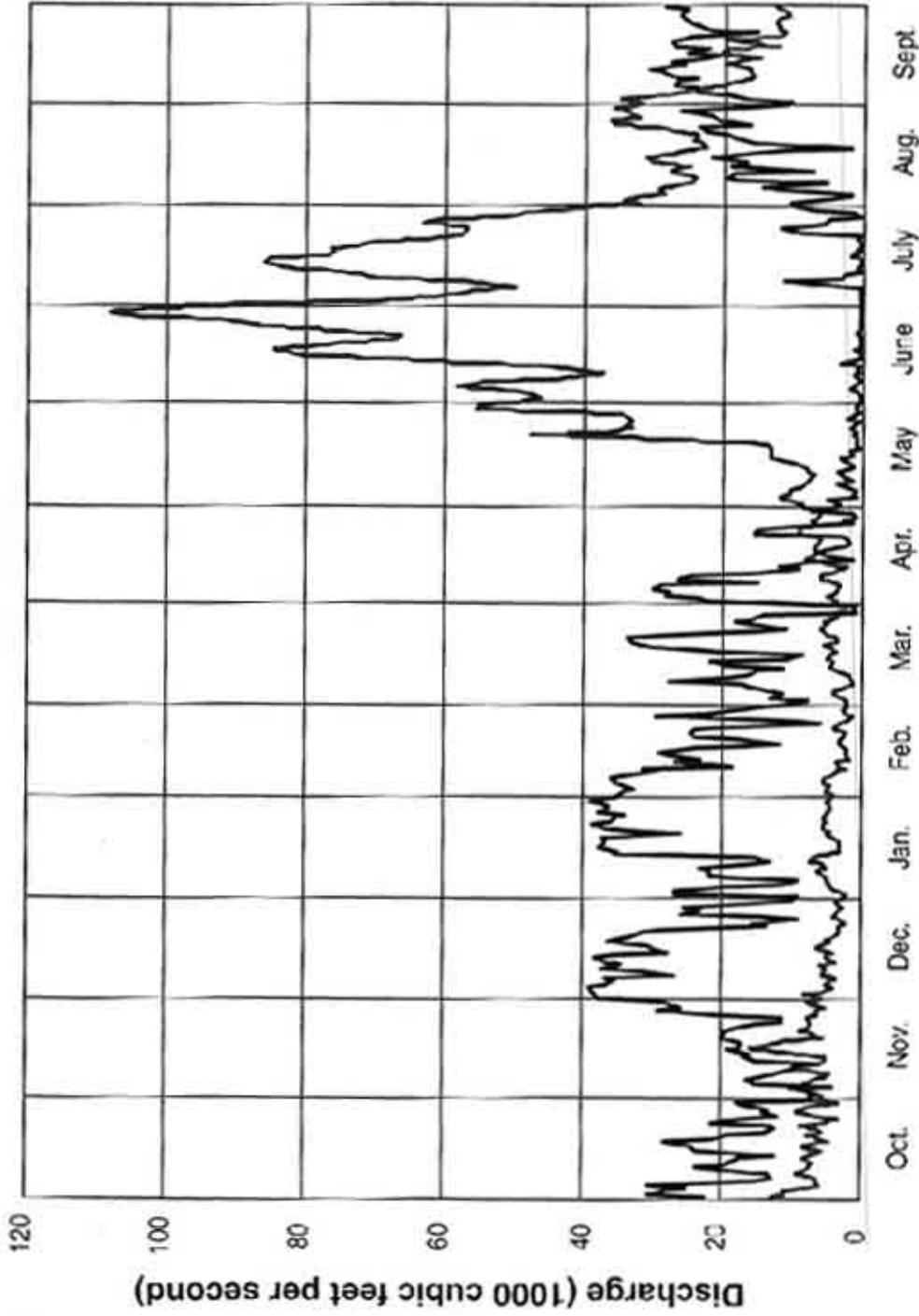
Libby Dam



Hydrograph: Observed and pre-project flows for the year ending September 30, 2002



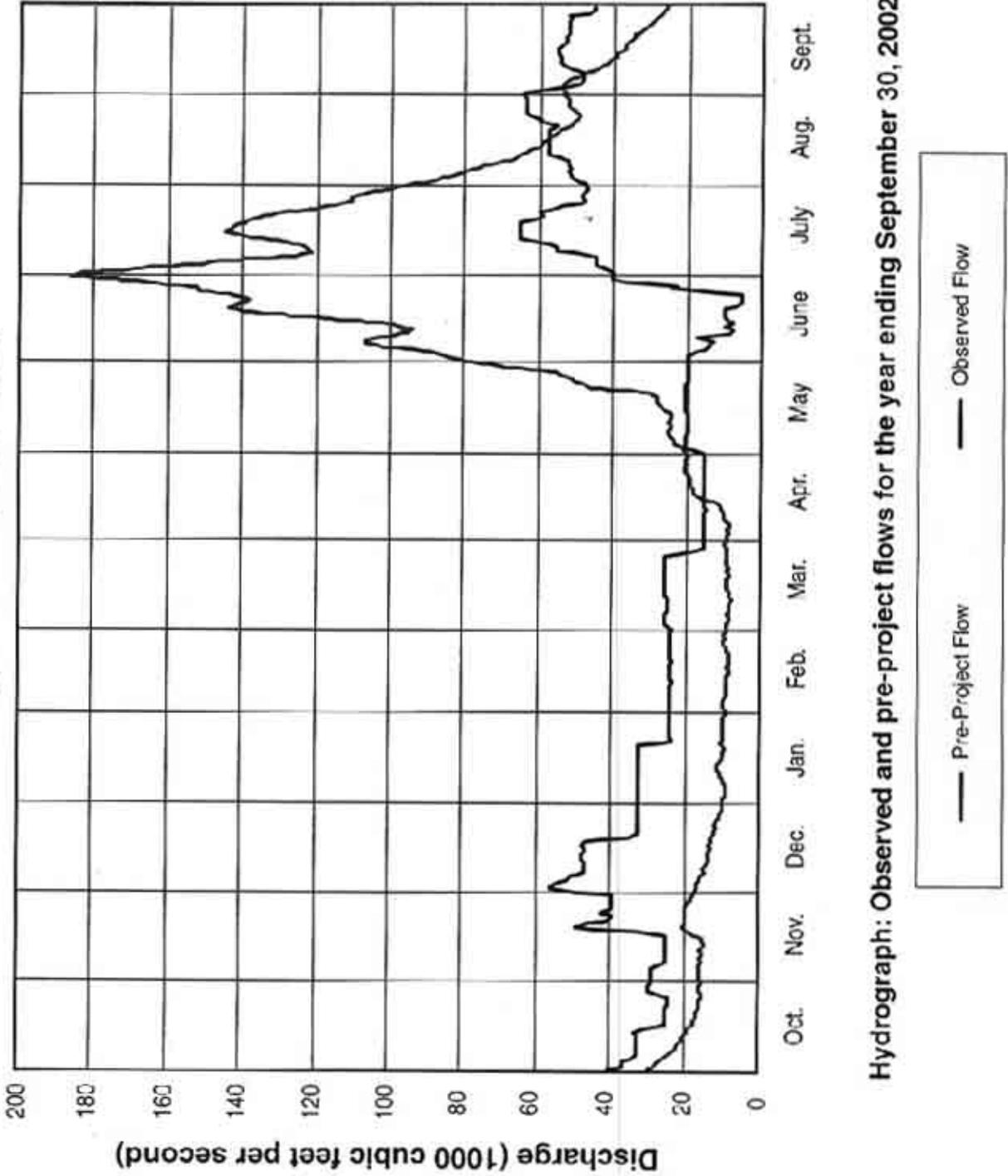
Mica Dam



Hydrograph: Observed and pre-project flows for the year ending September 30, 2002

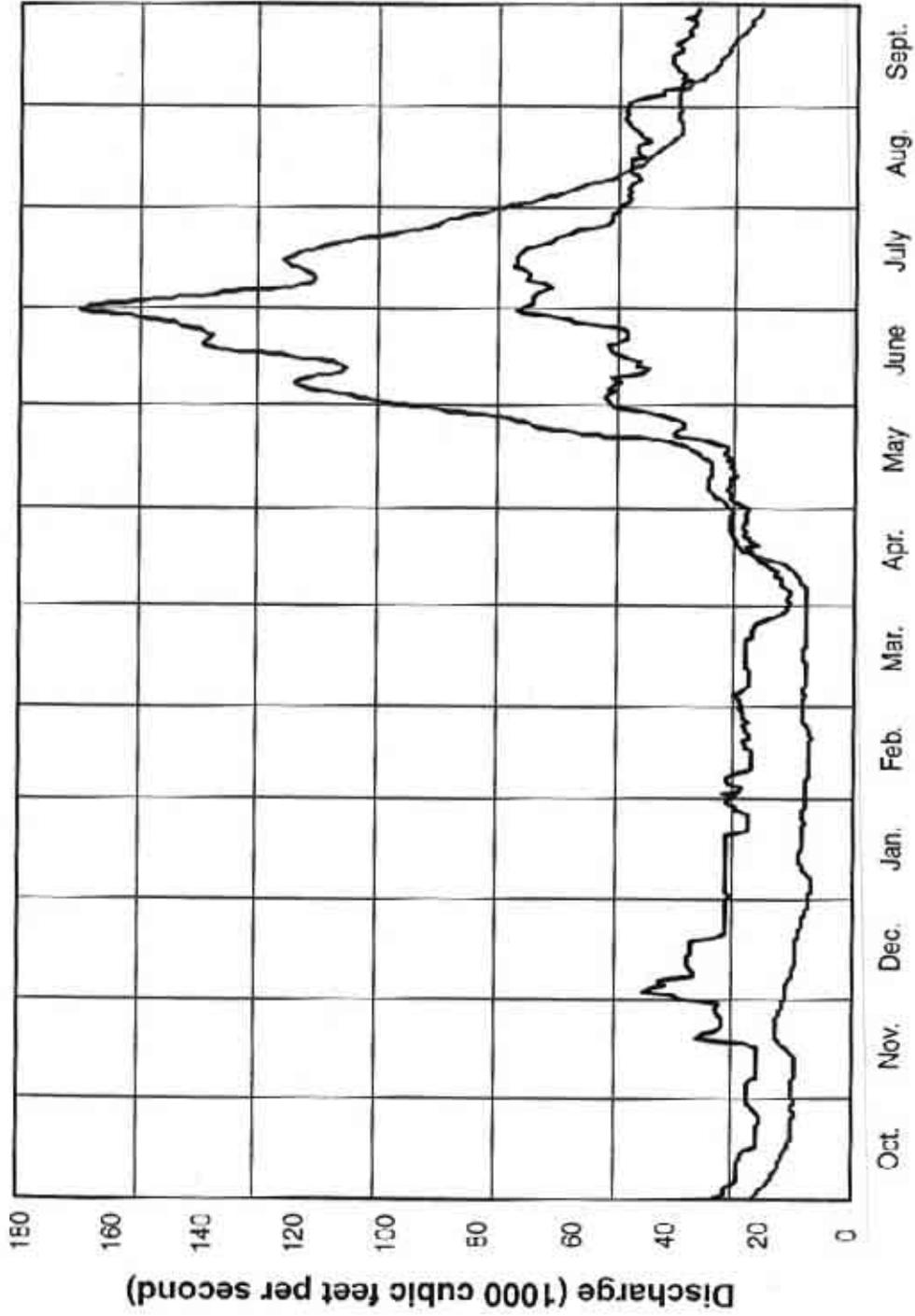


Hugh Keenleyside Dam



Hydrograph: Observed and pre-project flows for the year ending September 30, 2002

Birchbank



Hydrograph: Observed and pre-project flows for the year ending September 30, 2002



BENEFITS

Flood Control Benefits

There was no major Columbia River flooding during the 2001–2002 operating year. The reservoir system, including the *Columbia River Treaty* projects, had to draft for flood control in preparation for the spring freshet. The peak regulated flow and river stages are shown in the tables following.

Columbia River Streamflow at The Dalles, Oregon

Date	Peak Regulated Flow m ³ /s (cfs)	Date	Peak Unregulated Flow m ³ /s (cfs)
6 June 2002	10 600 (374 400)	7 June 2002	17 180 (606 800)

Columbia River Stage at Vancouver, Washington (flood stage = 4.89 metres [16.0 feet])

Date	Peak Regulated Stage metres (feet)	Date	Peak Unregulated Stage metres (feet)
18 April 2002	3.99 (13.1)	8 June 2002	6.34 (20.8)

It is estimated that the Duncan and Libby projects reduced the peak stage on Kootenay Lake by about 1.55 metres (m) (5.1 feet). The Duncan, Arrow, Mica and Libby projects reduced the peak stage of the Columbia River at Trail, British Columbia, by about 4.42 m (14.5 feet). The regulated peak stage at Trail, British Columbia, was about 2.38 m (7.8 feet) below flood stage. The effect of storage in the Duncan, Arrow, Mica and Libby reservoirs on flows at the sites, and on flows of the Columbia River at Birchbank, is illustrated by the hydrographs on pages 29 to 37. These show the actual discharges and the flows that would have occurred if the dams had not been built. The hydrograph showing pre-project conditions for Birchbank has been computed on the assumption that the effects of Duncan, Arrow, Mica and Libby regulation, and of the regulation provided by the Corra Linn development on Kootenay Lake, have been removed.

Power Benefits

Downstream power benefits in the United States, which arise from operation of the Canadian Treaty storage, were pre-determined for the first 30 years of operation of each

project, and the Canadian share was sold in the United States under the terms of the Canadian Entitlement Purchase Agreement. The U.S. Entity delivers capacity and energy to Columbia Storage Power Exchange participants, the purchasers of the Canadian Entitlement. Canada retains the benefits of additional generation made possible on the Kootenay River in Canada as a result of regulation provided by Libby, as well as generation at the Mica and Revelstoke projects. The benefits from Libby regulation, which occur downstream in the United States, are not shared under the Treaty.

The Canadian Entitlement Purchase Agreement expires in stages over 1998 to 2003. The portion of Canada's share of downstream power benefits attributable to each of the Treaty projects is the ratio of each project's storage to the whole of Canadian Treaty storage. The table below summarizes Canada's share of the downstream power benefits from each project:

Treaty Storage	Date Returnable	Share of Canadian Entitlement (%)
Duncan	1 April 1998	9.0
Arrow	1 April 1999	45.8
Mica	1 April 2003	45.2

After 1 April 2003, Canada's share of downstream benefits is fully returnable.

From 1 August 2001 through 31 July 2002, the U.S. Entity delivery of the Canadian Entitlement to downstream power benefits was 292.1 megawatts (MW) of average energy at rates up to 782.6 MW of capacity. The delivery from 1 August 2002 to 30 September 2002 was 293.1 MW of average energy at rates up to 642.0 MW of capacity.

The agreement between the Entities, signed on 20 November 1996, sets out the details of delivery points and the reliability of delivery for the downstream power benefits returnable to Canada beginning 1 April 1998 and will be completed on 1 April 2003. Further, on 31 March 1999, a diplomatic exchange of notes adopted an agreement permitting disposal of the Canadian Entitlement directly in the United States. The exchange also designated the Province of British Columbia as a Canadian Entity.

In accordance with the Entity Agreements on the Determination of Downstream Power Benefits for the operating year 2001–2002, the United States was not entitled to receive any compensating energy or capacity, as the optimum operation in both countries was not less than the optimum for the United States. In 2003, the United States is entitled to 0.3 MW of capacity and no energy. This small amount of capacity was waived by Entity agreement.

Other Benefits

By agreement between the Entities, stream flows are regulated for non-power purposes, such as accommodating construction in river channels and providing water to meet fish needs in both countries. These arrangements are implemented under the Detailed Operating Plan and other agreements to provide mutual benefits.

CONCLUSIONS

1. The Duncan, Arrow and Mica projects were operated in conformity with the Treaty during the 2001–2002 operating year. The operation reflected detailed operating plans developed by the Entities, the flood control operating plan for Treaty reservoirs and other agreements between the Entities.
2. The reporting year was characterized by the return to normal flow conditions in the Columbia River basin. Actual Canadian storage on 31 July 2002 reached 91.3 percent full, and the Treaty Storage Regulation level for Canadian storage was 91.8 percent full.
3. During the operating year, 1 August 2001 through 31 July 2002, the entitlements to the downstream power benefits accruing to each country from the Treaty storage were determined, according to the procedures set out in the Treaty and Protocol, to be 532.6 average megawatts (aMW) of energy and 1427.1 megawatts (MW) of capacity.
4. From 1 August 2001 through 31 July 2002, the U.S. Entity delivery of the Canadian Entitlement to downstream power benefits was 292.1 aMW of energy at rates up to 782.6 MW of capacity. The delivery from 1 August 2002 to 30 September 2002 was 293.1 aMW of average energy at rates up to 642.0 MW of capacity.
5. There was no significant flooding within the basin during the reporting period. With the 2002 water supply forecasts averaging near normal across the Columbia River Basin, the reservoir system – including the *Columbia River Treaty* projects – was required to draft for flood control in preparation for the spring freshet. During refill in late June–early July, Libby Dam had to spill for the first time in 21 years. The unregulated peak flow at The Dalles, Oregon, was estimated at 17 180 cubic metres per second (m^3/s) (606 800 cubic feet per second [cfs]) on 7 June 2002, and a regulated flow was estimated at 10 600 m^3/s (374 400 cfs) on 6 June 2002. The unregulated peak stage at Vancouver, Washington, was 6.34 m (20.8 feet) on 8 June 2002, and the high-observed stage was 3.99 m (13.1 feet) on 18 April 2002.
6. The Entities continued to operate the hydrometeorological network as required by the Treaty. The Hydrometeorological Committee prepared an annual report documenting the system according to the updated process adopted last year.
7. The requirements of the Treaty have generally been satisfied. However, the 2006–2007 and 2007–2008 Assured Operating Plans and Determinations of Downstream Power Benefits are currently behind the established schedule, which requires submission for the sixth consecutive year. The Entities plan to complete these reports by July 2003, and the delay is not expected to impact Treaty operations.

APPENDIX A

COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD

COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD

United States

Mr. Steven Stockton, Chair
Director of Programs Management
South Pacific Division
U.S. Army Corps of Engineers
San Francisco, California

Mr. Ronald Wilkerson
Consultant
Missoula, Montana

Mr. Earl Eiker
Consultant
Ellicott City, Maryland

Mr. George Bell
Consultant
Lake Oswego, Oregon

Mr. Robert Bank, P.E.
Engineering and Construction Division
Headquarters, U.S. Army Corps
of Engineers
Washington, D.C.

Canada

Members

Mr. Daniel Whelan, Chair
Director General
Energy Resources Branch
Natural Resources Canada
Ottawa, Ontario

Mr. Jack Ebbels
Deputy Minister
Ministry of Energy and Mines
Victoria, British Columbia

Alternates

Mr. David Burpee
Director, Renewable and Electrical Energy
Division
Energy Resources Branch
Natural Resources Canada
Ottawa, Ontario

Mr. Jim Mattison
Director, Water Management Branch
Land and Water British Columbia Inc.
Victoria, British Columbia

Secretaries

Mr. David Burpee
Director, Renewable and Electrical Energy
Division
Energy Resources Branch
Natural Resources Canada
Ottawa, Ontario

COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD
Record of Membership

United States		Canada	
Members			
Mr. Wendell Johnson ¹	1964–1970	Mr. Gordon McNabb ¹	1964–1991
Mr. Morgan Dubrow	1964–1970	Mr. Arthur Paget	1964–1973
Mr. John Neuberger	1970–1973	Mr. Valter Raudsepp	1973–1974
Mr. Joseph Caldwell ¹	1971–1973	Mr. Ben Marr	1974–1987
Mr. Homer Willis ¹	1973–1979	Mr. Tom Johnson	1987–1988
Mr. King Mallory	1973–1975	Mr. Douglas Horswill	1989–1991
Mr. Raymond Peck, Jr.	1976–1977	Mr. John Allan	1991–1999
Mr. Emerson Harper	1978–1988	Mr. David Oulton ¹	1991–1996
Mr. Lloyd Duscha ¹	1979–1990	Mr. Daniel Whelan ¹	1996–2002
Mr. Ronald Wilkerson	1988–	Mr. Charles Kang	1999–2001
Mr. Herbert Kennon ¹	1990–1994	Mr. Jack Ebbels	2001–
Mr. John Elmore ¹	1994–1996		
Mr. Steven Stockton ¹	1996–		

Alternates

Mr. Fred Thrall	1964–1974	Mr. Mac Clark	1964–1992
Mr. Emerson Harper	1964–1978	Mr. Jim Rothwell	1964–1965
Mr. Alex Shwaiko	1974–1987	Mr. Hugh Hunt	1966–1988
Mr. Herbert Kennon	1987–1990	Dr. Donald Kasianchuk	1988–1996
Mr. Thomas Weaver	1979–1997	Mr. Vic Niemela	1992–1994
Mr. John Elmore	1990–1994	Mr. David Burpee	1994–
Mr. Paul Barber	1994–1995	Mr. Jack Farrell	1996–1997
Mr. Daniel Burns	1995–1997	Mr. Prad Kharé	1997–1999
Mr. George Bell	1997–	Mr. Jim Mattison	1999–
Mr. Earl Eiker	2000–		

Secretaries

Mr. John Roche	1965–1969	Mr. Mac Clark	1964–1992
Mr. Verle Farrow	1969–1972	Mr. David Burpee	1992–
Mr. Walter Duncan	1972–1978		
Mr. Shapur Zanganeh	1978–1995		
Mr. Richard DiBuono	1995–2000		
Mr. Robert Bank	2000–		

¹Chair

**COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD
ENGINEERING COMMITTEE**

Current Membership

United States

Mr. Robert Bank, P.E., Chair
Engineering and Construction Division
Headquarters, U.S. Army Corps
of Engineers
Washington, D.C.

Mr. Kamau Sadiki
Water Management Division
U.S. Army Corps of Engineers
Northwestern Division
Portland, Oregon

Mr. Michael Cowan, P.E.
Office of Technical Services
Western Area Power Administration
Lakewood, Colorado

Mr. James Fodrea, P.E.
U.S. Bureau of Reclamation
Pacific Northwest Region
Boise, Idaho

Canada

Mr. Roger McLaughlin, P.Eng., Chair
Electricity Policy Branch
Ministry of Energy and Mines
Victoria, British-Columbia

Ms. Donna Clarke, P.Eng.
Renewable and Electrical Energy Division
Natural Resources Canada
Ottawa, Ontario

Dr. Bala Balachandran, P.Eng.
Water Management Branch
Land and Water British Columbia Inc.
Victoria, British Columbia

Mr. Ivan Harvie, P.Eng.
Renewable and Electrical Energy Division
Natural Resources Canada
Calgary, Alberta

APPENDIX B

COLUMBIA RIVER TREATY ENTITIES

COLUMBIA RIVER TREATY ENTITIES

United States

Canada

Members

Mr. Steven Wright, Chair
Acting Administrator and
Chief Executive Officer
Bonneville Power Administration
Department of Energy
Portland, Oregon

Mr. Larry Bell, Chair
British Columbia Hydro and Power
Authority
Vancouver, British Columbia

BG David Fastabend
Division Engineer
U.S. Army Engineer Division,
North Pacific
Portland, Oregon

APPENDIX C

**RECORD OF FLOWS
AT THE
INTERNATIONAL BOUNDARY**

Kootenai River at Porthill, Idaho

Daily discharges (in thousands of cubic feet per second) for the year ending 30 September 2002

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	6.6	7.6	9.8	8.4	16.0	12.1	8.0	16.8	40.0	46.7	20.7	11.8
2	6.7	7.2	10.0	8.4	15.9	11.6	8.6	18.2	36.3	47.8	22.0	10.0
3	6.7	7.1	10.3	10.0	15.7	11.4	8.4	19.6	34.2	47.7	21.2	9.0
4	6.7	7.0	10.4	10.4	15.6	11.3	8.3	20.1	32.7	46.2	20.9	8.1
5	6.5	6.9	10.3	10.5	15.9	11.2	8.3	18.7	32.6	43.1	20.8	7.4
6	6.5	7.0	10.1	10.6	19.6	11.2	8.6	17.1	36.5	38.3	22.9	7.3
7	6.6	6.9	9.9	10.9	23.6	10.8	9.9	15.8	38.3	34.6	23.1	7.1
8	6.5	6.9	9.7	16.7	24.7	10.4	11.2	14.6	36.8	30.8	23.0	7.2
9	6.5	6.8	9.5	21.1	23.7	9.7	11.6	13.5	34.8	29.4	20.6	7.0
10	6.6	6.8	9.6	18.1	19.5	9.0	11.6	12.9	32.9	29.2	19.2	7.0
11	6.6	6.7	9.7	18.7	15.2	8.3	12.3	12.3	33.3	28.9	19.2	7.2
12	6.6	6.7	9.6	18.6	12.9	8.5	13.6	12.2	34.0	30.1	19.1	7.0
13	6.6	6.7	9.7	18.1	11.1	8.5	17.1	12.9	39.2	31.0	18.7	7.0
14	6.7	7.2	9.7	17.6	10.3	7.9	27.5	14.9	41.6	31.2	18.1	7.0
15	6.7	8.3	9.9	17.2	9.5	7.6	38.0	16.9	42.5	31.3	18.1	7.0
16	6.6	8.9	9.8	15.7	9.4	7.6	31.8	19.6	43.3	32.7	18.0	6.9
17	6.5	9.2	10.0	15.5	9.4	7.4	24.3	20.1	43.0	31.1	18.0	6.9
18	6.6	9.1	10.2	16.3	9.5	7.3	19.8	20.6	42.2	26.9	16.7	6.9
19	6.5	8.2	10.0	16.1	9.4	7.2	17.4	22.3	41.8	24.9	17.0	6.9
20	6.6	7.8	10.0	16.1	9.4	7.5	16.0	27.3	40.4	24.6	17.8	7.1
21	6.6	7.6	10.0	16.1	9.4	7.0	15.9	34.0	38.7	24.7	18.1	7.0
22	6.5	7.5	10.0	16.0	9.9	6.9	16.3	47.6	37.8	22.5	18.1	6.9
23	6.5	7.5	9.8	15.8	15.7	6.9	16.8	50.1	37.6	23.5	18.0	6.8
24	6.6	7.4	9.5	15.7	18.4	6.9	16.1	41.6	37.6	24.3	18.0	6.9
25	6.6	7.5	8.6	16.0	15.2	6.9	15.1	34.5	36.5	24.2	18.0	6.8
26	6.6	7.2	8.5	16.4	13.5	6.8	14.6	31.6	38.5	24.1	18.1	6.9
27	6.3	7.2	8.3	16.3	12.7	7.0	14.2	32.2	42.4	24.1	17.8	7.0
28	6.9	7.2	8.3	16.1	12.4	7.2	14.0	36.2	42.9	24.0	16.2	6.9
29	6.8	9.3	8.4	16.0	-	7.3	14.1	41.5	44.7	24.1	15.8	6.8
30	6.8	9.7	8.4	15.9	-	7.3	15.2	44.5	47.0	24.1	15.3	6.8
31	7.0	-	8.5	16.0	-	7.5	-	43.2	-	24.1	13.7	-
Mean	6.6	7.6	9.6	15.3	14.4	8.5	15.5	25.3	38.7	30.7	18.8	7.3

Columbia River at Birchbank, British Columbia

Daily discharges (in thousands of cubic feet per second) for the year ending 30 September 2002

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	56.9	43.8	71.7	52.3	49.4	46.6	27.1	46.6	101.7	138.1	97.8	96.1
2	52.6	43.8	75.6	52.3	54.0	48.0	27.4	50.5	103.1	135.6	96.1	93.6
3	52.6	43.4	86.9	52.6	48.4	48.4	27.3	51.6	104.2	135.6	94.3	86.9
4	52.6	43.4	83.0	52.6	45.9	49.8	27.2	51.9	102.8	135.6	95.4	80.5
5	50.1	43.4	77.7	52.6	51.9	47.3	26.9	51.2	100.7	133.1	94.6	80.9
6	47.7	42.0	81.2	52.6	52.6	44.5	28.6	53.0	103.8	130.3	95.4	72.8
7	47.7	39.9	75.6	52.6	53.0	43.8	31.0	51.6	101.4	127.1	93.9	73.1
8	47.7	39.9	66.0	53.0	48.7	44.1	30.4	51.9	98.2	131.0	93.2	69.6
9	47.3	39.9	65.7	53.0	43.4	44.1	30.8	51.2	102.4	138.4	90.8	72.4
10	48.0	39.9	67.5	53.3	42.7	44.1	32.6	49.4	94.6	136.3	91.1	72.0
11	47.3	39.6	69.6	53.0	42.7	44.1	32.4	50.1	89.3	136.0	94.3	74.5
12	47.3	39.6	69.6	53.0	42.4	44.1	34.7	50.1	86.5	139.9	94.3	75.6
13	47.0	39.9	68.5	53.0	42.4	44.5	36.7	51.2	91.5	143.0	94.3	76.6
14	47.0	39.9	68.9	53.0	42.7	44.5	39.6	50.9	90.1	142.3	94.3	77.0
15	45.2	39.9	68.2	53.0	42.7	44.5	39.9	52.6	94.3	142.0	93.9	77.0
16	42.0	40.3	68.2	53.0	44.9	44.5	42.0	51.9	98.9	141.3	89.3	76.3
17	40.3	44.5	68.2	52.6	44.5	44.5	42.7	54.0	102.4	140.6	91.5	73.1
18	40.3	57.9	68.2	53.0	45.9	44.9	45.2	53.7	102.1	139.9	91.8	73.5
19	40.3	65.3	65.0	53.0	44.1	44.9	39.2	53.7	102.8	137.7	91.8	75.2
20	40.3	62.9	57.2	53.0	44.1	44.9	44.1	56.5	98.9	129.6	88.3	72.4
21	40.3	57.2	53.0	48.0	44.9	44.9	44.1	63.6	95.0	127.1	85.8	71.0
22	40.3	54.7	53.0	44.1	44.9	43.1	47.0	73.1	95.0	125.0	90.4	68.5
23	39.6	54.0	53.0	44.1	46.6	42.0	45.6	75.2	95.7	120.4	90.4	70.3
24	38.8	54.4	53.0	44.1	44.1	42.4	45.9	74.2	96.4	116.2	93.2	69.6
25	37.8	54.7	52.6	44.1	46.3	41.0	46.6	71.7	102.4	110.2	94.3	68.2
26	37.8	55.1	52.6	44.1	46.3	40.6	45.6	71.7	117.6	104.2	95.4	67.5
27	39.2	56.5	52.6	44.1	45.9	38.5	44.9	73.5	119.0	102.1	96.4	71.7
28	41.0	56.5	52.6	48.7	47.3	33.7	44.9	79.1	130.3	101.7	96.4	67.5
29	43.1	55.1	52.6	49.1	-	30.4	44.5	83.0	139.5	101.7	95.7	66.4
30	44.1	62.5	52.6	52.6	-	28.4	43.8	87.9	141.6	99.6	96.4	66.0
31	43.8	-	52.6	52.6	-	27.3	-	101.0	-	98.9	95.0	-
Mean	44.7	48.3	64.6	50.7	46.2	42.5	38.0	60.9	103.4	127.1	93.4	74.5

APPENDIX D

PROJECT INFORMATION

Power and Storage Projects, Northern Columbia Basin

Plate No. 1

Project Data:

Duncan Project

Table 1

Arrow Project

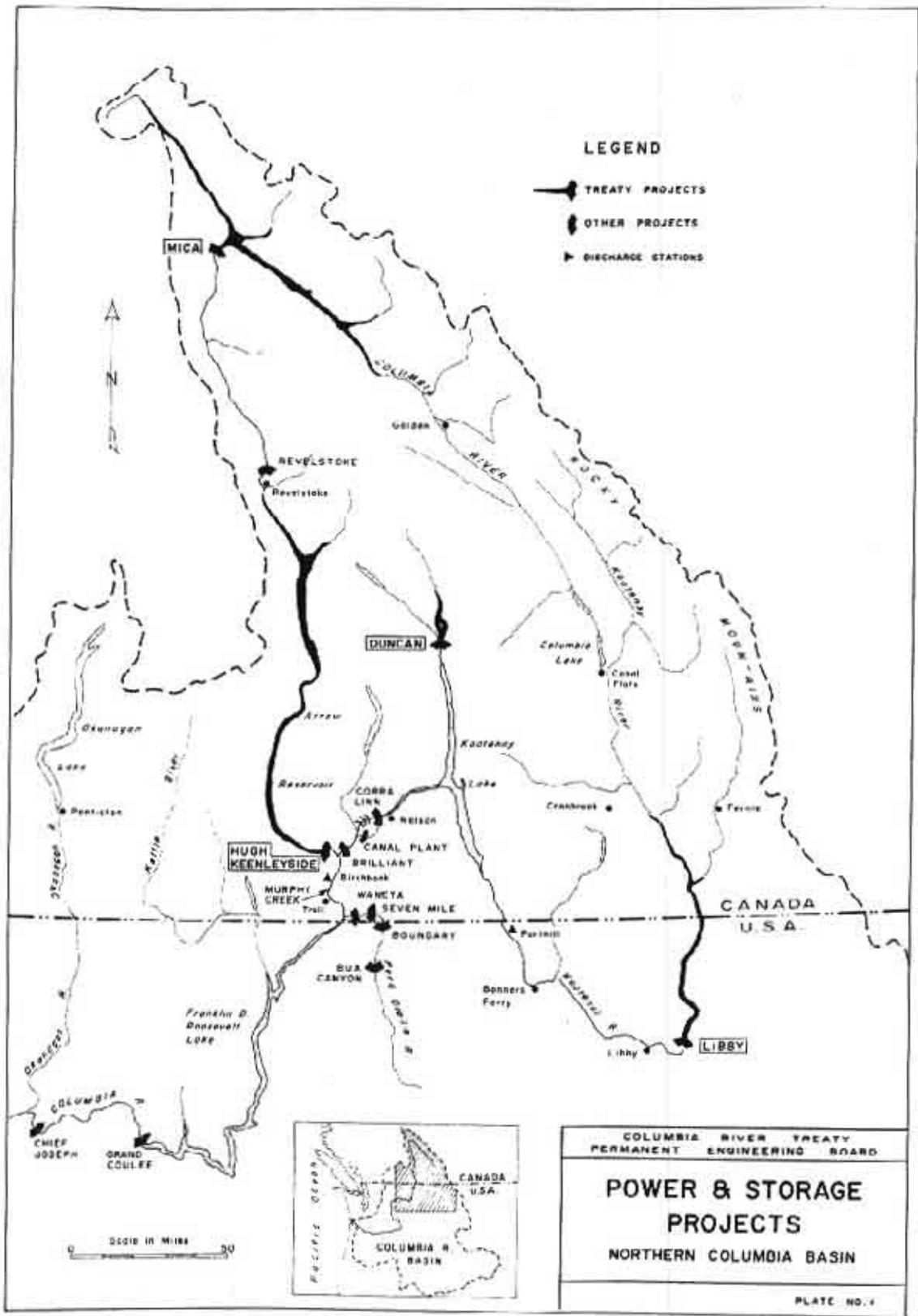
Table 2

Mica Project

Table 3

Libby Project

Table 4



LEGEND

- TREATY PROJECTS
- OTHER PROJECTS
- ▶ DISCHARGE STATIONS

COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD

**POWER & STORAGE
PROJECTS**

NORTHERN COLUMBIA BASIN

PLATE NO. 4

POWER AND STORAGE PROJECTS

Northern Columbia Basin

TABLE 1

DUNCAN PROJECT

Duncan Dam and Duncan Lake

Storage Project

Construction began	17 September 1964
Storage became fully operational	31 July 1967

Reservoir

Normal full pool elevation	577 metres (m) (1892 feet)
Normal minimum pool elevation	547 m (1794.2 feet)
Surface area at full pool	7290 hectares (18 000 acres)
Total storage capacity	1.77 cubic kilometres (km ³) (1 432 400 acre-feet)
Usable storage capacity	1.73 km ³ (1 400 000 acre-feet)
Treaty storage commitment	1.73 km ³ (1 400 000 acre-feet)

Dam, Earthfill

Crest elevation	581 m (1907 feet)
Length	792.5 m (2600 feet)
Approximate height above riverbed	39.6 m (130 feet)
Spillway – Maximum capacity	1350 m ³ /s (47 700 cfs)
Discharge tunnels – Maximum capacity	570 m ³ /s (20 000 cfs)

Power Facilities

None

TABLE 2
ARROW PROJECT
Hugh Keenleyside Dam and Arrow Lakes

Storage Project

Construction began	March 1965
Storage became fully operational	10 October 1968

Reservoir

Normal full pool elevation	440 m (1444 feet)
Normal minimum pool elevation	420 m (1377.9 feet)
Surface area at full pool	52 650 hectares (130 000 acres)
Total storage capacity	10.3 km ³ (8 337 000 acre-feet)
Usable storage capacity	8.8 km ³ (7 100 000 acre-feet)
Treaty storage commitment	8.8 km ³ (7 100 000 acre-feet)

Dam, Concrete Gravity and Earthfill

Crest elevation	445 m (1459 feet)
Length	869 m (2850 feet)
Approximate height above riverbed	52 m (170 feet)
Spillway – Maximum capacity	6700 m ³ /s (240 000 cfs)
Low-level outlets – Maximum capacity	3740 m ³ /s (132 000 cfs)

Power Facilities

Currently installed	
two units at 92.5 megawatts (MW)	185 MW
Power commercially available	2002
Head at full pool (Gross maximum head)	23.6 m (77 feet)
Maximum turbine discharge	1200 m ³ /s (42 400 cfs)

TABLE 3
MICA PROJECT
Mica Dam and Kinbasket Lake

Storage Project

Construction began September 1965
 Storage became fully operational 29 March 1973

Reservoir

Normal full pool elevation 754.4 m (2475 feet)
 Normal minimum pool elevation 707.1 m (2320 feet)
 Surface area at full pool 42 930 hectares (106 000 acres)
 Total storage capacity 24.7 km³ (20 000 000 acre-feet)
 Usable storage capacity 14.8 km³ (12 000 000 acre-feet)
 Treaty storage commitment 8.6 km³ (7 000 000 acre-feet)

Dam, Earthfill

Crest elevation 762.0 m (2500 feet)
 Length 792.5 m (2600 feet)
 Approximate height above foundation 244 m (800 feet)
 Spillway – Maximum capacity 2250 m³/s (150 000 cfs)
 Outlet works – Maximum capacity 1080 m³/s (37 400 cfs)

Power Facilities

Designed ultimate installation
 six units at 434 MW 2604 MW
 Power commercially available December 1976
 Currently installed
 four units at 434 MW 1736 MW
 Head at full pool 183 m (600 feet)
 Maximum turbine discharge of four units at full pool 1080 m³/s (38 140 cfs)

TABLE 4
LIBBY PROJECT
Libby Dam and Lake Koocanusa

Storage Project

Construction began	June 1966
Storage became fully operational	17 April 1973

Reservoir

Normal full pool elevation	749.5 m (2459 feet)
Normal minimum pool elevation	697.0 m (2287 feet)
Surface area at full pool	18 830 hectares (46 500 acres)
Total storage capacity	7.2 km ³ (5 869 000 acre-feet)
Usable storage capacity	6.1 km ³ (4 980 000 acre-feet)

Dam, Concrete Gravity

Deck elevation	753.5 m (2472 feet)
Length	916.0 m (3055 feet)
Approximate height above riverbed	112.8 m (370 feet)
Spillway – Maximum capacity	4106 m ³ /s (145 000 cfs)
Low-level outlets – Maximum capacity	1730 m ³ /s (61 000 cfs)

Power Facilities

Designed ultimate installation eight units at 105 MW	840 MW
Power commercially available	24 August 1975
Currently installed five units at 105 MW	525 MW
Head at full pool	107.0 m (352 feet)
Maximum turbine discharge five units at full pool	745.6 m ³ /s (26 500 cfs)